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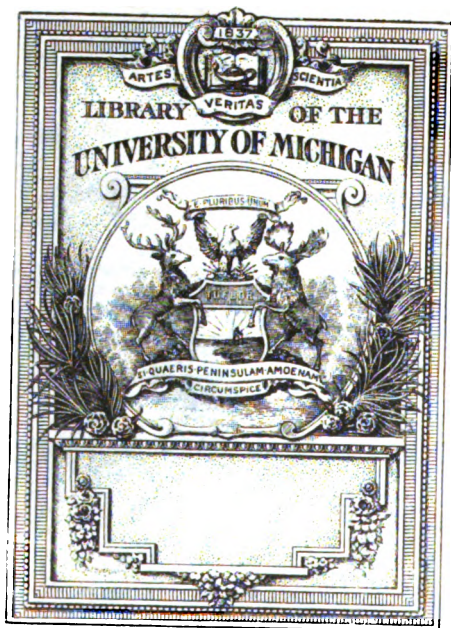
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JOURNAL
OF
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INSTRUCTIONS TO ABSTRACTORS,

GIVING THE

NOMENCLATURE AND SYSTEM OF NOTATION

ADOPTED IN THE ABSTRACTS.

The object of the abstracts of chemical papers published elsewhere than in the Transactions of the Society is to furnish the Fellows with a concise account of the progress of chemical science from month to month. It must be understood that as the abstracts are prepared for the information of the Fellows in general, they cannot possibly be made so full or so detailed as to obviate on the part of those who are engaged on special investigations the necessity of consulting the original memoirs.

1. Titles of papers must be given literally.
2. Before beginning to write the abstract, the whole of the original paper must be read, in order that a judgment may be formed of its importance and of the scale on which the abstract should be made.
3. In the case of papers dealing with subjects not strictly chemical, the abstract should refer only to matters of chemical interest in the original.
4. The abstract should consist mainly of the expression, in the abstractor's own words, of the substance of the paper.
5. The abstract should be made as short as is consistent with a clear and accurate statement of the author's results.
6. If an abstract of a paper on the same subject, either by the author of the paper abstracted, or by some other author, has already appeared, note should, as a rule, be made of this fact.
7. Matter which has appeared once in the *Abstracts* is not to be abstracted again, a reference being given to the volume in which the abstract may be found.
8. As a rule, details of methods of preparation or analysis, or generally speaking of work, are to be omitted, unless such details are essential to the understanding of the results, or have some independent value. Further, comparatively unimportant compounds, such as the inorganic salts of organic bases or acids, should be mentioned quite shortly. On the other hand, data such as melting and boiling points, sp. gr., specific rotation, &c., must be given in every case unless recorded in earlier papers.

Nomenclature.

9. Employ names such as *sodium chloride*, *potassium sulphate* for inorganic compounds, and use the terminals *ous* and *ic* only in distinguishing compounds of different orders derived from the same elementary radicle; such, for instance, as mercurous and mercuric chlorides, sulphurous and sulphuric acids.

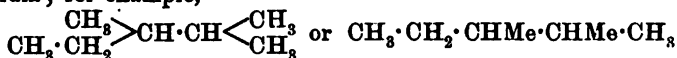
10. Term compounds of metallic radicles with the OH-group *hydroxides* and not hydrates, the name hydrate being reserved for compounds supposed to contain water of combination or crystallisation.

11. Term salts containing an amount of metal equivalent to the displaceable hydrogen of the acid, *normal* and not neutral salts, and assign names such as sodium hydrogen sulphate, disodium hydrogen phosphate, &c., to the acid salts. Basic salts as a rule are best designated merely by their *formulae*.

12. Names in common use for oxides should be employed, for example: NO, nitric oxide; CO₂, carbon dioxide; P₄O₁₀, phosphoric oxide; As₂O₃, arsenious oxide; Fe₂O₃, ferric oxide.

13. In open chain compounds, Greek letters must be used to indicate the position of a substituent, the letter α being assigned to the first carbon atom in the formula, except in the case of CN and CO₂H, for example, CH₃·CH₂·CH₂·CH₂I α -iodobutane, CH₃·CH₂·CH₂·CN α -cyanopropane.

14. Isomeric open chain compounds are most conveniently represented as substitution derivatives of the longest carbon chain in the formula; for example,



should be termed $\beta\gamma$ -dimethylpentane, not methylethylisopropylmethane, and $\begin{array}{c} \text{CH}_3 \\ \diagup \\ \text{CH}_3 \end{array} > \text{CH} \cdot \text{CH} < \begin{array}{c} \text{CH}_3 \\ \diagdown \\ \text{CO}_2\text{H} \end{array}$ or CH₃·CHMe·CHMe·CO₂H should be termed $\alpha\beta$ -dimethylbutyric acid, not $\alpha\beta\beta$ -trimethylpropionic, or α -methylisovaleric, or methylisopropylacetic acid.

15. Use names such as methane, ethane, &c., for the normal paraffins or hydrocarbons of the C_nH_{2n+2} series of the form CH₃·[CH₂]_n·CH₃, &c. Term the hydrocarbons C₂H₄ and C₂H₂ ethylene and acetylene respectively (not ethene and ethine). Homologues of the ethylene series are to be indicated by the suffix *-ene*, and those of the acetylene series, wherever possible, by *-ine*. Adopt the name allene for the hydrocarbon CH₂:C:CH₂.

16. Distinguish all hydroxyl derivatives of hydrocarbons by names ending in *ol*. Alcohols should be spoken of as mono-, di-, tri-, or n-hydric, according to the number of OH-groups. Compounds which are not alcohols, but for which names ending in *ol* have been used, are to be represented by names ending in *ole*, if a systematic name cannot be given, thus anisole not anisoil, indole not indol. Compounds such as MeONa, EtONa, &c., should be termed sodium methoxide, sodium ethoxide, &c.

17. The radicles indicated in the name of a compound are to be

given in the order fluoro-, chloro-, bromo-, iodo-, nitro-, nitroso-, amino-, imino-, cyano-, thiocyno-, hydroxy-.

18. Compounds analogous to the acids of the lactic series containing the OH-group should be termed *hydroxy*-derivatives, and not *oxy*-derivatives; for example, hydroxyacetic and not oxyacetic acid. Compounds containing the analogous groups OEt, OPh, OAc, &c., should in like manner be termed ethoxyl, phenoxy, acetoxy derivatives. Thus α -ethoxypropionic acid, $\text{OEt}\cdot\text{CHMe}\cdot\text{CO}_2\text{H}$, instead of ethyl-lactic acid; 3:4-diethoxybenzoic acid, $(\text{OEt})_2\text{C}_6\text{H}_3\cdot\text{CO}_2\text{H}$, instead of diethylprotocatechuic acid; and α -acetoxypropionic acid, $\text{OAc}\cdot\text{CHMe}\cdot\text{CO}_2\text{H}$, instead of acetyl-lactic acid. Terms such as diethylprotocatechuic acid should be understood to mean a compound formed by the displacement of hydrogen atoms in the hydrocarbon radicle of protocatechuic acid by ethyl, viz., $\text{C}_6\text{H}_5\text{Et}_2(\text{OH})_2\cdot\text{CO}_2\text{H}$, and not $\text{C}_6\text{H}_5(\text{OEt})_2\cdot\text{CO}_2\text{H}$, just as dibromoprotocatechuic acid is understood to be the name of a compound of the formula $\text{C}_6\text{HBr}_2(\text{OH})_2\cdot\text{CO}_2\text{H}$.

19. The term *ether* should be restricted to the oxides of hydrocarbon radicles and their derivatives, and the esters (so-called compound ethers or ethereal salts) should be represented by names similar to those given to metallic salts.

20. When a substituent is one of the groups NH_2 , NHR , NR_2 , NH or NR , its name should end in *ino*; for example, β -aminopropionic acid, $\text{NH}_2\cdot\text{CH}_2\cdot\text{CH}_2\cdot\text{CO}_2\text{H}$, β -anilino-acrylic acid, $\text{NHPh}\cdot\text{CH}\cdot\text{CH}\cdot\text{CO}_2\text{H}$, α -iminopropionic acid, $\text{NH}\cdot\text{CMe}\cdot\text{CO}_2\text{H}$.

21. Compounds of the radicle SO_3H should, whenever possible, be termed sulphonic acids, or failing this, sulpho-compounds; for example, benzenesulphonic acid, sulphobenzoic acid.

22. Basic substances should invariably be indicated by names ending in *ine*, as aniline instead of anilin, the termination *in* being restricted to certain neutral compounds, viz., glycerides, glucosides, bitter principles, and proteids, such as palmitin, amygdalin, albumin. The compounds of basic substances with hydrogen chloride, bromide or iodide should always receive names ending in *ide* and not *ate*, as morphine hydrochloride and not morphine hydrochlorate.

23. The Collective Index, 2nd decade (1883—1892) should be adopted as the standard of reference on questions of nomenclature not provided for in the preceding sections.

Notation.

24. In empirical formulæ the elements are to be given in the order C, H, O, N, Cl, Br, I, F, S, P, and the remainder alphabetically.

25. Equations should be omitted unless essential to the understanding of the results; as a rule, they should not be written on a separate line, but should "run on" with the text.

26. To economise space, it is desirable:

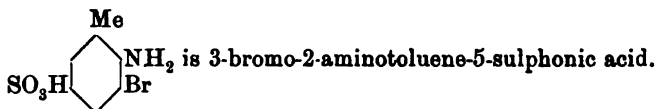
- (a) That *dots* should be used instead of *dashes* in connecting contiguous symbols or radicles, whenever this does not interfere with the clearness of the formula.

- (b) That formulæ should be shortened by the judicious employment of the symbols Me for CH_3 , Et for C_2H_5 , Pr^a for $\text{CH}_2\cdot\text{CH}_2\cdot\text{CH}_3$, Pr^s for $\text{CH}(\text{CH}_3)_2$, Ph for C_6H_5 , Py for $\text{C}_5\text{H}_4\text{N}$, Ac for $\text{CO}\cdot\text{CH}_3$, and Bz for $\text{CO}\cdot\text{C}_6\text{H}_5$.

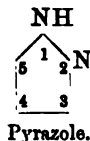
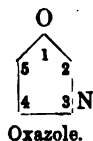
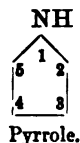
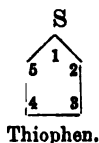
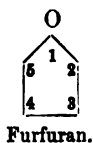
- (c) That formulæ should be written in *one line* whenever this can be done without obscuring their meaning.

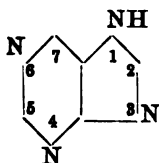
27. In representing the constitution of benzene derivatives, the relative positions of the radicles in the symbol of benzene should be indicated by numerals, instead of by means of the hexagon formula.

- (a) The abbreviations *o*-, *m*-, and *p*-, should be used in place of 1:2- or ortho-, 1:3- or meta-, and 1:4- or para.
- (b) In numbering positions in the case of substitution derivatives of phenol, aniline, benzonitrile, benzoic acid, benzenesulphonic acid, benzaldehyde, and toluene, the characteristic radicle of each of these parent substances is to be regarded as in position 1 (compare Collective Index).
- (c) Names of substitution derivatives should be given in such a way that the position of the substituent is indicated by a numeral prefixed; for example:—

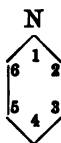


28. In representing the constitution of derivatives of other "closed chain" hydrocarbons, graphic formulæ should not be employed, but the system of numbering positions indicated in Richter's *Lexikon der Kohlenstoff-Verbindungen* (2nd edition, 1899, pp. 16—26) should be used, of which the following schemes may be regarded as typical:—

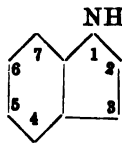




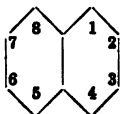
Purine



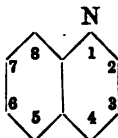
Pyridine.



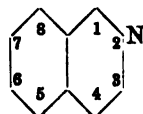
Indole.



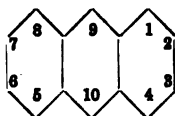
Naphthalene.



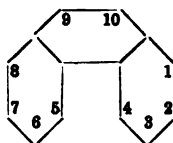
Quinoline.



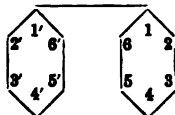
iso-Quinoline.



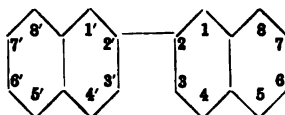
Anthracene.



Phenanthrene.



Diphenyl.

 $\beta\beta$ -Dinaphthyl.

Manuscript.

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30. Not more than one abstract must appear on a sheet.

31. When an abstract exceeds a sheet in length, the sheets must be fastened together by means of gum at the top left-hand corner.

32. The name of the abstractor must be written diagonally at the top left-hand corner of the first sheet of the abstract.

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33. Abstractors are expected to read and correct proofs carefully, and to check all formulæ and figures against MSS.

34. All proofs, however small, must be returned to the Sub-Editor not later than 24 hours after receipt from the printers.

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JOURNAL

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ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN
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PART II.

General and Physical Chemistry.

Influence of Slight Impurity on the Spectrum of a Gas. By PERCIVAL LEWIS (*Ann. Phys. Chem.*, 1899, [ii], 69, 398—425).—The spectrum of pure hydrogen was compared with that obtained when the gas contained small quantities of (a) mercury vapour, (b) oxygen, (c) water vapour, external electrodes being employed. With the apparatus used, the intensity of the hydrogen spectrum was a maximum at a pressure of 3 mm. When a small trace of mercury vapour was present, the green mercury line appeared in the spectrum at all temperatures above -20° , its intensity being for a given hydrogen pressure proportional to the density of the mercury vapour. The appearance of the mercury line was accompanied by a diminished intensity of both the simple and compound hydrogen spectra. For pressures less than 6 mm., the relative intensities of the hydrogen and mercury spectra appear to be proportional to their densities; the addition of 4 per cent. of mercury vapour to pure hydrogen diminishes by half the intensity of the latter spectrum.

When hydrogen contains a small quantity of oxygen, the intensity of the hydrogen spectrum is increased if the pressure is less than 1.5 mm., and diminished if the pressure is greater. The similarity of the effect produced by water vapour is probably to be explained by the formation of the latter, when a discharge passes through hydrogen containing a trace of oxygen.

The observations made lead to the conclusion that the compound spectrum is really characteristic of hydrogen, and not due to any impurities.

The spectrum of oxygen containing a trace of mercury vapour gave no evidence of the presence of the latter; the addition, however, of a trace of hydrogen was followed immediately by the appearance of the green mercury line, a phenomenon which it is difficult to explain satisfactorily. J. C. P.

Phototropy. By WILHELM MARCKWALD (*Zeit. physikal. Chem.*, 1899, 30, 140—145).—The anhydrous chloride of quinoquinoline (Abstr., 1894, i, 474), on exposure to light, changes in colour from yellow to an intense green, and returns to its original state immediately at 90°, or in the dark at ordinary temperatures in a few days. The change is brought about in a few seconds by bright sunlight, and in a few minutes by diffused daylight, and is chiefly due to the more refrangible rays: Röntgen rays have no effect. Similar changes are obtained with β -tetrachloro- α -ketonaphthalene (Abstr., 1888, 710), which, by crystallisation from solvents, forms colourless, transparent crystals; these, when powdered and exposed to light, change to an amethyst colour, whilst large crystals become pleochroic, exhibiting a reddish-violet colour in one direction. The change does not appear to be connected with any chemical or crystallographic alteration, and by fusion a non-sensitive modification can be obtained which slowly returns to the sensitive form. To these phenomena, the author applies the term phototropy. L. M. J.

Concentration-cells with Unalterable Electrodes. By KARL SCHAUM (*Zeit. Elektrochem.*, 1899, 5, 316—319).—If two electrodes of a material which is not acted on by the electrolytes to be employed are immersed in solutions of an oxidising agent and of the substance formed by its reduction, a galvanic cell is formed, the E.M.F. of which is proportional to the absolute temperature, and depends on the relative concentrations of the ions present, but not on their chemical nature.

The E.M.F. is given by the formula $E = RT/n\epsilon \log.(c_1c'_2)/(c_2c'_1)$, where n is the difference between the number of electrical charges carried by the ion in question in its higher and lower stages of oxidation, $\epsilon = 96540$ coulombs, c_1 and c_2 are the concentrations of the ions of the higher and lower stage of oxidation respectively in one solution, and c'_1 and c'_2 the same quantities in the other solution.

Some experiments with solutions containing potassium ferro- and ferri-cyanides and platinum electrodes gave numbers which were in satisfactory agreement with the requirements of the formula. T. E.

Theory of Lead Accumulators. By F. DOLEZALEK (*Zeit. Elektrochem.*, 1899, 5, 533—539).—In a previous paper (Abstr., 1898, ii, 551), the author obtained, by thermodynamics, a formula showing the relation between the E.M.F. of a lead accumulator and the concentration of the sulphuric acid used in it. For concentrations not exceeding 1 gram-molecule per litre, this may be simplified to the form,

$$E_2 - E_1 = 0.000198 \nu T [\log_{10} c_2/c_1 + 0.009 (c_2 - c_1)]$$

where E_1 and E_2 are the E.M.F. s of accumulators containing acid of

the concentrations c_1 and c_2 respectively, and ν is the average number of ions formed from 1 molecule of sulphuric acid. The same formula is obtained by means of Nernst's osmotic theory, whether the theory of the chemical action of the accumulator due to Liebenow or that due to Le Blanc is assumed to be true. The formula is shown to be in good agreement with experimental results.

The E.M.F. of an accumulator filled with a saturated solution of lead sulphate is 1.25 volts at 0° . Combining this with the E.M.F. found for an acid of known concentration, it is easy to calculate, from the formula, the concentration of the sulphuric acid formed by hydrolytic dissociation in the lead sulphate solution. The calculation shows that 15 per cent. of the lead sulphate has suffered hydrolytic dissociation.

The E.M.F. of an accumulator containing a saturated solution of lead oxide in $N/10$ sodium hydroxide solution is 0.8 volt, and this is shown to be practically identical with the E.M.F. which an accumulator filled with pure water would possess. From this, the concentration of the hydrogen ions in pure water is readily calculated to be 0.33×10^{-7} gram-mol. per litre, in excellent agreement with the determination of Kohlrausch and Heydweiller.

Measurements are made of the difference of potential between a hydrogen electrode and the positive or negative plate of an accumulator in sulphuric acid of various concentrations, which are also shown to be in agreement with the author's theory. Similar measurements and calculations are made with a mercury-mercurous sulphate electrode.

The results obtained with the hydrogen electrode are of interest in connection with the gradual discharge of accumulators when not in use. This is due to the presence of particles of impurities in the plates which give rise to local electrolytic action; on the lead plate, hydrogen must be evolved on the surface of the impurity giving rise to a hydrogen-lead couple, on the peroxide plate, oxygen is evolved on the surface of the impurity, producing a lead peroxide-oxygen couple. The E.M.F.'s of these couples in acids of different concentration are as follows:—

	4.86	9.33	19.76	26.36	52.93 per cent. H_2SO_4
$PbO_2 : O_2$	0.55	0.56	0.59	0.62	0.72 volt.
$Pb : H_2$	0.27	0.28	0.32	0.34	0.43 volt.

Since the E.M.F. of the couples and the conductivity of the acid both increase as the concentration of the acid increases, the rate of discharge of the plates increases rapidly with increasing concentration of the acid, which is quite in accordance with practical experience. T. E.

Dielectrical Researches and Electrical Waves. By W. D. COOLIDGE (*Ann. Phys. Chem.*, 1899, [ii], 69, 125—166).—An electrical resonance method of determining the dielectric constant is described, which differs from that of Drude (compare Abstr., 1897, ii, 438) in that the condenser with the substance to be examined is in the oscillating system instead of in the receiving system. Comparison of the results obtained with a number of esters shows the method to be trustworthy and accurate; the author estimates that, by a few measurements,

the dielectric constant can be determined with a probable error of only 0.1 per cent.

At 14°, the dielectric constants of several liquefied gases have the following values: sulphur dioxide, 13.75; ammonia, 16.2; chlorine, 1.88. Linde found 14.8 for the sulphur dioxide constant at 23°, and 1.93 for the chlorine constant at 14°.

The temperature coefficient of the dielectric constant of water is found to be -0.432 per cent. at 17°, a value agreeing with the results of Drude and Heerwagen.

The anomalous absorption of water, previously observed up to $\lambda = 10$ cm., can, by the author's method, be determined up to $\lambda = 147$ cm., for which wave-length the absorption index = 0.0082. The absorption indices of a few esters have also been determined.

The value 4.35 is found for the dielectric constant of ether at 17.8°, in close agreement with Drude's determination. Experiments with mixtures of ether and chloroform confirm the existence of a maximum dielectric constant, found by Philip (compare Abstr., 1898, ii, 9) by a slow vibration method.

From the formula,

$$(\sqrt{\epsilon} - 1).100/d = (\sqrt{\epsilon_1} - 1).p_1/d_1 + (\sqrt{\epsilon_2} - 1)(100 - p_1)/d_2,$$

where ϵ , ϵ_1 , ϵ_2 are the dielectric constants of a mixture and its two components, d , d_1 , d_2 the corresponding densities, and p_1 the percentage of one component; the author has calculated the dielectric constants of a number of alcohols in dilute benzene and toluene solution. These calculated dielectric constants diminish with falling concentration, and approach limiting values agreeing closely with those determined by Philip (*loc. cit.*) with Nernst's apparatus. Thus for the alcohols slow and rapid vibration methods lead to the same limiting values, which may be considered free from electrical dispersion.

The paper contains also a theoretical discussion of the method employed and the phenomena described.

J. C. P.

Electrical Charges of freshly prepared Gases from Electrolytic Sources. By WILHELM KÖSTERS (*Ann. Phys. Chem.*, 1899, [ii], 69, 12—33).—The author confirms Townsend's results (*Phil. Mag.*, 1898, [vi], 45, 125), who showed that gases obtained by electrolysis have a positive or negative charge, according to the nature of the gas and the electrolyte employed, but rejects the theory that the phenomenon is to be explained by the escape of undischarged ions from the electrolyte. A connection is rather suggested with the observation of Lenard (*Ann. Phys. Chem.*, 1892, [ii], 46, 584), that air is negatively electrified when falling drops of water encounter an obstacle, and with the closely allied phenomenon of a gas being electrified by its passage through water.

Gases rendered non-electric and freed from dust particles by filtration through a tube connected to earth and filled with moist cotton wool were bubbled through various electrolytes. A comparison of the electrification produced with that obtained in electrolytic gases showed that the charges in the two cases generally agreed in sign, but were not at all proportional in quantity. Further, the ratio of the

charge to the volume of gas was much greater in the case of the electrolytic gases, but experiment showed that this might be due to the presence of fine particles of the electrolyte.

When hydrogen is bubbled through pure water, the former acquires a considerable negative charge; this action, however, is prevented by very small quantities of any dissolved substance. For a number of inorganic acids and salts, the electrifying action is found to vary with the concentration in a similar manner. In concentrated solutions, the action either is *nil* or approaches that value. The electrification of hydrogen bubbled through sulphuric acid of sp. gr. 1.3 is independent of the temperature. Absorption of the gas by the liquid slightly diminishes the electrification produced.

J. C. P.

Change of Resistance of Lead Dioxide. By TH. SUNDORPH (*Ann. Phys. Chem.*, 1899, [ii], 69, 319—323).—When two brass rods, separated by a layer of lead dioxide, have a potential difference of 33 volts (the exact value depending on the state of compression of the dioxide), the current produced first increases, and then decreases, reaching finally a constant value. This behaviour is probably due to the heat developed, which is greatest at the positive electrode, and to the formation of badly conducting monoxide. When the heat is supplied externally, and the current strength is determined at intervals, the latter is found to change in the same way as before. The period during which the current strength increases is lengthened when the potential is less than 33 volts, and shortened when the potential is greater than 33 volts, ultimately vanishing altogether. In the latter case, the rise of temperature is slight, and the amount of dioxide decomposed small compared with the great and sudden increase of resistance; the decomposition is probably due to sparks, chiefly in the neighbourhood of the electrodes.

J. C. P.

Electrolytic Conductivity of Pure Substances. By RICHARD ABEGG (*Zeit. Elektrochem.*, 1899, 5, 353—355).—In order that a pure substance shall possess electrolytic conductivity, its chemical constitution must be such that ions may be formed from it, its dielectric constant should be high, and it should not contain a large proportion of polymerised molecules, since these cannot dissociate directly into ions. Many substances with large dielectric constants (water, methyl and ethyl alcohols, formic acid) consist mainly of polymerised molecules and are therefore bad conductors. Others, with large dielectric constants and small polymerisation, are unsuitably constituted; nitrobenzene, ethyl nitrate, and benzonitrile, for example, contain the groups NO_2 , NO_3 , and CN , which readily form ions, but on the other hand, they contain the groups C_6H_5 and C_2H_5 , which have never been observed in the form of ions.

Fused salts, in all probability, possess high dielectric constants, their chemical constitution is very favourable to the formation of ions, nothing is known of their association factor. They form the only group of pure substances with any considerable electrolytic conductivity.

In the case of solutions, it is extremely probable that the capacity of the ions to unite with molecules of the solvent has an important

influence on the degree of dissociation. Solutions in water and liquid anhydrous ammonia are mentioned as illustrations of this.

T. E.

Influence of Substituents on the Electrical Conductivity of Benzoic Acid. By ALFRED TINGLE (*J. Amer. Chem. Soc.*, 1899, 21, 792—803).—The conductivities of the alkali salts of benzoic acid and several halogen derivatives have been determined in aqueous solution for $v = 64$ and $v = 128$. The numbers obtained do not agree with the rule that the difference between the conductivities of two metals is constant, and independent of the acid with which they are combined; the deviation from this rule is most marked in the case of sodium and potassium iodobenzoates.

J. C. P.

Electrical Conductivity of Non-aqueous Solutions. By AZARIAH T. LINCOLN (*J. Physical Chem.*, 1899, 3, 457—494).—The paper contains an account of an extensive investigation of the electrical conductivity of solutions of inorganic salts in solvents other than water. The compounds employed were the chlorides of aluminium, chromium, manganese, zinc, cobalt, nickel, copper, cadmium, arsenic, tin, potassium and lithium, nitrates of lead and silver, cyanides of mercury and silver, and copper sulphate, while as solvents the following liquids were used:—Ethyl, propyl, allyl, benzyl alcohols; benzaldehyde, salicylaldehyde, furfuraldehyde, acetone, methyl propyl ketone, acetophenone, ethyl acetate, ethyl monochloroacetate, ethyl cyanoacetate, ethyl acetoacetate, ethyl benzoate, ethyl oxalate, ethyl nitrate, amyl nitrite; nitrobenzene *o*-nitrotoluene, aniline, xylidine, benzonitrile, pyridine, piperidine, quinoline, phosphorus trichloride, and tin tetrachloride. Although with methyl and ethyl alcohols, limiting values for the molecular conductivity were reached, yet as a general rule this is not the case, and the values for the dissociation in propyl alcohol given by Schlamp (*Abstr.*, 1894, ii, 376) are, on this account, not justified. Solutions in ketones conduct, the highest values being obtained with acetone; in some cases, the molecular conductivity was found to decrease after certain dilutions. Pyridine yields conducting solutions, as does nitrobenzene, but here also limiting values are seldom indicated. It hence follows that as a general rule dissociation values cannot be calculated except in a few cases with alcoholic solutions, and in these the agreement of the values with those obtained by other methods is not satisfactory. Many conducting solutions have been found to give normal molecular weights by the boiling point methods, as, for example, solutions in acetone (Dutoit, *Abstr.*, 1899, ii, 350), and in benzonitrile and pyridine (Werner, *Abstr.*, 1897, ii, 214), so that in non-aqueous solutions there is no agreement between the evidence concerning dissociation afforded by the different methods. In alcoholic solutions also, in which considerable dissociation occurs, the results are not in accord with the dilution law of either Ostwald or Rudolphi. Examination of the degrees of association of the various solvents used indicates that the theories of Dutoit and of Crompton (*Trans.*, 1897, 71, 925), that only associated solvents yield conducting solutions, are untenable, inasmuch as many solutions of high conductivity were

obtained with non-associated solvents. Comparisons of dielectric constants show that while, as a general rule, solvents with high constants yield solutions that conduct well, yet there is no proportionality between the two values (see Brühl, *Abstr.*, 1899, ii, 735; this vol., ii, 11). The author hence considers that the dissociation theory, in its present form, cannot be applied to explain the conductivity of non-aqueous solutions, and urges the desirability of obtaining further data (compare *Abstr.*, 1899, ii, 397; also Kahlenberg, *Abstr.*, 1899, ii, 624).

L. M. J.

Electrolytic Gas Development. By WILLIAM A. CASPARI (*Zeit. physikal. Chem.*, 1899, 30, 89—97).—At ordinary temperatures, hydrogen is liberated at 1.55 to 1.56 volts, and with higher E.M.F.'s a mixture of oxygen with excess of hydrogen is obtained, whilst at a temperature of 98° to 100°, hydrogen production occurs at 1.33 volts (see Le Blanc, *Abstr.*, 1894, ii, 4; Nernst, *Abstr.*, 1897, ii, 394). After long electrolysis, hydrogen peroxide or persulphuric acid is present in the liquid. With electrodes of spongy platinum, the cathodic electrolysis is completely reversible; with bright platinum, a slight excess of tension was necessary for the liberation of hydrogen, whilst with other metals this excess of tension is considerable, and the electrolysis is hence non-reversible; it is least for those metals which possess the greatest occlusion capability. Experiments on the electrolysis of solutions of potassium bromide or potassium iodide in *N* sulphuric acid proved that the precipitation of the bromine or iodine on platinum electrodes is reversible; this is also found to be the case for the precipitation of silver on silver electrodes in solution of silver nitrate, or of double cyanides.

L. M. J.

Magnetic Susceptibility of Inorganic Compounds. By STEFAN MEYER (*Ann. Phys. Chem.*, 1899, [ii], 69, 236—263).—The magnetic susceptibility of a number of inorganic compounds in the form of powder has been determined by the balance method previously employed in the case of elements (compare *Abstr.*, 1899, ii, 587). The molecular magnetism is the coefficient of susceptibility divided by the number of gram-molecules per litre of space. Experiments in which the field strength varied from 6000 to 10000 (C.G.S. units) showed that the coefficient of susceptibility, except for ferric oxide, is independent of the field strength.

A compound of two diamagnetic elements is always diamagnetic, and a compound of two paramagnetic elements is generally paramagnetic, but may be diamagnetic, as in the case of beryllium, magnesium and aluminium oxides, and silica. Oxygen always lowers the susceptibility of an element, and thus the oxides of paramagnetic elements may be diamagnetic; the lowering effect is greater the greater the proportion of oxygen atoms in the oxide. Besides chromium, manganese, iron, cobalt, and nickel, there is another series of strongly magnetic elements—lanthanum, cerium, praseodymium, neodymium, ytterbium, samarium, gadolinum, and erbium, arranged in order of increasing magnetic susceptibility. The susceptibility of erbium oxide is about four times that of ferric oxide. The molecular magnetism of paramagnetic com-

pounds is less than the sum of the atomic magnetisms of the components, as shown by the oxides of chromium, manganese, iron, cobalt, and nickel. For diamagnetic substances, the molecular magnetism is approximately additive. That the molecular magnetism is not purely additive is shown by the fact that the value for a hydrated salt differs from the value for the anhydrous salt by less than the amount calculated for the water of crystallisation.

The molecular magnetism of the halogen compounds of a metal increases with the atomic weight of the halogen, and a similar law holds for compounds of different alkali metals with the same halogen.

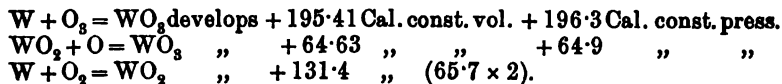
The connection between the atomic volume and the magnetic susceptibility of the elements is shown by an atomic volume curve. Strongly magnetic elements are found at the minima and the parts of the curve immediately preceding, the chief exception being oxygen which, however, behaves in compounds as if it were diamagnetic. Polonium and radium in their compounds are found to be paramagnetic, and thus these elements will probably find a place at minima of the atomic volume curve. The connection between atomic volume and magnetic susceptibility is confirmed by the fact that when the atomic volume decreases with fall of temperature, the susceptibility increases: further, in compounds where there is an increase of volume, the susceptibility decreases.

J. C. P.

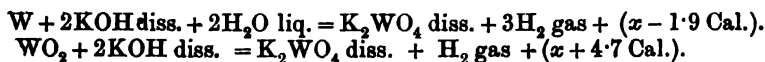
A Simple Protection for Fused-in Platinum Wires. By WILHELM PALMAER (*Ber.*, 1899, 32, 2570—2571).—Where a platinum wire has to be fused into the wall of a glass vessel, as is frequently the case in electrochemical apparatus, it is recommended to have only a very short piece of wire projecting outside the vessel; surrounding this wire is a small piece of narrow glass tubing fused on to the glass vessel. By pouring mercury into this glass tube, contact is made, and the danger of breaking the platinum wire or of splintering the glass around its point of entry is avoided.

T. H. P.

Heat of Oxidation of Tungsten. By MARCEL DELÉPINE and L. A. HALLOPEAU (*Compt. rend.*, 1899, 129, 600—603).—When finely divided tungsten is burnt in oxygen in the calorimetric bomb, the heat liberated per gram is 1062 cal., whilst the dioxide WO_2 , under similar conditions, gives 299.2 cal. It follows that



The heat developed by combination with the successive atoms of oxygen is approximately the same, and is practically identical with the heat of oxidation of iron, which explains the interactions of water, tungsten, hydrogen, and tungstic anhydride at different temperatures. The results also explain the reactions of tungsten with various metallic oxides, the reduction of tungstic anhydride by certain metals only, and the reduction of mercuric, cupric, platonic, silver and gold salts by the red and blue tungsten oxides.



C. H. B.

A Simplification of Beckmann's Boiling Point Apparatus. By SAMUEL L. BIGELOW (*Amer. Chem. J.*, 1899, 22, 280—287).—To obviate the danger of superheating, and to secure a constant heating effect independent of changes of gas pressure, the author adopts as the source of heat a spiral of thin platinum wire immersed in the solvent and heated by means of an electric current of constant strength; the boiling vessel adopted is the same as in Beckmann's method, but is surrounded by a layer of felt to avoid cooling by radiation and convection. The electric connection to the heating wire is furnished by two glass tubes filled with mercury, passing through the cork and reaching nearly to the bottom of the vessel; through the lower ends of these are fused platinum hooks on which the heating spiral is suspended. The beads which are necessary in Beckmann's method to ensure uniformity of temperature and avoid superheating are not required with the new apparatus. Although, in general with electric heating, the results are normal, remarkably low values are obtained with very dilute solutions which point to dissociation occurring, "under the conditions of the experiment, of non-electrolytes in solvents to which it is not usual to ascribe dissociating power"; the author intends investigating this question.

W. A. D.

Relation between Pressure and Evaporation. By EDWIN H. HALL (*J. Physical Chem.*, 1899, 3, 452—456).—Nernst derives the equation of reaction isotherms from the consideration of a system in which a reaction proceeds in a given direction, and in which the concentration is maintained constant by the introduction and removal of the compounds reacting and produced in the states of solids or non-miscible liquids, and he assumes that the work required for this is zero. This necessitates equality of volumes, and the author hence introduces an additional term $P(\bar{V} - \bar{V}')$ and applies the altered equation to the case of a single liquid or solid in the presence of its gaseous phase. Expressions are thus obtained for the vapour density, as a function of external pressure, for water over ice at -10° and over liquid water at 0° .

L. M. J.

Density of Liquids and Saturated Vapours. By RUDOLF VON HIRSCH (*Ann. Phys. Chem.*, 1899, [ii], 69, 456—478).—The densities of toluene, *o*-xylene, *m*-xylene, *p*-xylene, propionic acid, normal and iso-butyric acids, both as liquids and saturated vapours, have been determined at 190° , 212° , 237° , and 276° , the boiling points of dimethylaniline, diethylaniline, isobutyl benzoate and bromonaphthalene respectively. The method adopted was essentially that of Young (*Trans.* 1891, 59, 37 and 911).

When D and d are the densities at a given temperature of liquid and saturated vapour respectively, the mean values $(D + d)/2$ for different temperatures lie on a straight line in all cases examined, in conformity with Matthias' law. The curve connecting density and temperature would thus naturally be a parabola, but the actual curve

is found to differ from the parabolic form in being flattened at the vertex.

The constants a and b of van der Waal's equation, calculated from the determined densities, are found to alter with the temperature, b slowly increasing and a generally diminishing with rising temperature; a increases with the temperature only in the case of p -xylene.

The author criticises the commonly accepted theory of the critical point, and considers illogical the view that the densities of liquid and vapour are equal at the critical temperature. The existence of a critical point is denied, for both liquid and vapour are regarded as having a critical density. From this point of view, van der Waal's assumptions that at the critical point $dp/dv = 0$ and $d^2p/dv^2 = 0$ are not justified.

J. C. P.

Phenomena of Effusion of Permanent Gases. By ROBERT EMDEN (*Ann. Phys. Chem.*, 1899, [ii], 69, 264—289 and 426—453).—When a gas issues under pressure from a narrow opening, stationary sound waves are formed in the jet. Photographs of the jet afford a means of measuring the wave-length and determining its variation with the size of aperture, with the pressure of the gas flow, and with the chemical nature of the gas. Experiments with air, carbon dioxide, and hydrogen show that, for a given size of aperture and a given gas pressure, the wave-length is independent of the molecular weight of the gas.

J. C. P.

Van't Hoff's Equation and the Molecular Weights of Liquids. By CLARENCE L. SPEYERS (*J. Amer. Chem. Soc.*, 1899, 21, 725—732. Compare Abstr., ii, 1898, 213).—The equations $n/(N+n) = (p-p')/p$ and $n/N = (p-p')/p'$, where n and N are the number of gram-molecules of solute and solvent, p and p' the vapour pressures of solvent and solution respectively, give numbers agreeing well with observation, whilst the equation $n/N = U(p/p')$ is not at all in harmony with experiment, especially at higher concentrations. The molecular weight of acetic acid calculated by this formula from Linebarger's experiments on a mixture of benzene and acetic acid has quite absurd values. The author deduces the latter equation by a process similar to that employed by van't Hoff, but is unable to suggest any correction which would bring the formula into harmony with experiment.

J. C. P.

A New Inorganic Dissociative Solvent. By PAUL WALDEN (*Ber.*, 1899, 32, 2862—2871).—Liquid sulphur dioxide has a remarkable power of dissolving the most varied substances, both inorganic and organic, the solutions often showing a characteristic colour: thus potassium, sodium, and ammonium iodides all dissolve readily, forming yellow solutions. Among soluble organic substances are benzene, naphthalene, ethyl alcohol, benzoic acid, phenol, ethyl acetate, aniline, diphenylamine, α - and β -naphthylamine. The solutions of diphenylamine and α -naphthylamine are blood-red in colour, that of β -naphthylamine is orange.

The fact that the dissolved substances react readily with each other

points to their being electrolytically dissociated: thus by double decomposition $\text{KI} + \text{NH}(\text{CH}_3)_3\text{Cl} = \text{KCl} + \text{NH}(\text{CH}_3)_3\text{I}$; all these substances are soluble in liquid sulphur dioxide except potassium chloride, which is accordingly precipitated. Ammonium thiocyanate and sublimed ferric chloride give a blood-red colour, exactly as in aqueous solution.

The conductivity of sulphur dioxide solutions is considerable, and in some cases greater than that of equally concentrated aqueous solutions. The increase of the molecular conductivity with dilution is irregular, and for the iodides much more marked than in their aqueous solutions. Ammonium salts in sulphur dioxide solution have a smaller conductivity than potassium or rubidium salt solutions of equal concentration: the conductivity of ammonium, tetramethylammonium, and tetraethylammonium iodides increases with the complexity of the positive ion. The difference between μ_{512} and μ_{16} for potassium iodide is greater in sulphur dioxide solution than in aqueous solution; hence both the degree of dissociation and the ionic velocities differ in the two solvents.

As a further test of the degree of dissociation, determinations of the molecular weight were carried out, the boiling point method being employed. The molecular rise of the boiling point of sulphur dioxide was calculated to be 15° , and with this constant the method gave normal and steady values for the molecular weights of naphthalene, toluene, and acetanilide. The iodides of potassium, sodium, rubidium, and ammonium give a value for the molecular weight which is nearly twice the normal value, whilst certain other salts, such as potassium thiocyanate and tetramethylammonium iodide, have approximately the theoretical molecular weight, thus behaving like non-electrolytes.

An explanation of this abnormal behaviour, which is to a certain extent analogous to that of liquid ammonia solutions (compare *Abstr.*, 1899, ii, 202), is reserved until further investigations have been made.

J. C. P.

Nature of Colloidal Solutions. By K. STOECKL and LUDWIG VANINO (*Zeit. physikal. Chem.*, 1899, 30, 98—112).—The authors consider that colloidal metallic solutions consist of suspensions of extremely finely divided solid particles, and give the following reasons for their view. By boiling there is no continuous change in the boiling point, and the suspended material is almost completely precipitated after short boiling. Colloidal solutions bring about elliptic polarisation of light, which could be caused by solid particles, the diameters of which are smaller than the wave-length of the light, whilst, further, the colour of colloidal gold solutions is also explicable on the assumption that they contain small suspended particles. The electrical properties of these solutions and their behaviour to dialysers are also in accord with this view of their nature. The same reasoning may also be applied in the case of colloidal solutions of metallic sulphides.

L. M. J.

Function of the Medium in Chemical Change. By JULIUS WILHELM BRÜHL (*Zeit. physikal. Chem.*, 1899, 30, 1—63).—The velocity of the tautomeric change of ethyl mesityloxidoxalate from the enolic

to the ketonic form has been investigated in various solvents, and found to vary greatly with the nature of the latter (Abstr., 1899, ii, 735). The dissociative powers of solvents are closely associated with their dielectric constants (Abstr., 1894, ii, 266), and the same is found to obtain for their powers of inducing the above tautomeric change. No absolute proportionality exists, or can be expected, inasmuch as the dielectric constant varies greatly with temperature and also with the frequency of the electrical waves. This dissociative power is regarded as due to a form of energy which the author terms the "medial energy"; this, although not identical, is closely connected with the heat energy of the compound. The internal energy of a compound cannot be actually determined, since physical and chemical changes are only connected with changes of energy, but it is probable that it is greatest in compounds with the highest specific heat, and latent heat of fusion or evaporation. The examination of these constants for a large number of compounds indicates that high values are also generally associated with high dielectric constants and dissociative power. For the recognition and estimation of the tautomeric forms (chemical methods are not available, and cryoscopic methods are untrustworthy), the author considers the best methods to be the determination of the optical properties or the electrical conductivity.

L. M. J.

Gaseous Reactions in Chemical Kinetics. VI. and VII. By MAX BODENSTEIN (*Zeit. physikal. Chem.*, 1899, 30, 113—139).—The author gives a detailed account of the various thermostats used in his researches on gaseous reactions (Abstr., 1899, ii, 548, 637, 638, 639, 733). For vapour baths, sulphur, phosphorus pentasulphide, mercury, and diphenylamine were employed; for liquid baths, oil, lead, and an alloy of tin and lead. Temperatures were measured by mercury thermometers containing carbon dioxide under pressure, and by an air thermometer, and he considers the temperatures accurate to one degree. In summarising the results of the whole work, the author considers he has proved that gaseous reactions proceed continuously, and only at the absolute zero would an absolute inertness be reached, and hence that the assumption of a state of "false equilibrium" is erroneous. In the oxidation of phosphorus or phosphorus trihydride, the reaction apparently ceases at certain pressures of oxygen; in these cases, however, the reaction is very complicated, and the author does not consider that the supposition of a state of false equilibrium is necessitated (see also Duhem, Abstr., 1899, ii, 739).

L. M. J.

Application of the Equilibrium Law to the Formation of Oceanic Salt Deposits with Especial Reference to the Stassfurt Beds. II. Equilibrium Relations of Carnallite. By JACOBUS H. VAN'T HOFF and WILHELM MEYERHOFFER (*Zeit. physikal. Chem.*, 1899, 30, 64—88. Compare Abstr., 1898, ii, 564).—The authors have previously investigated the solubility curves for magnesium chloride, and the present paper contains an extension of this work to carnallite, but the diagrams and curves are necessary for the complete explanation of the results. Below zero, the following equilibrium points are obtained: — 11.1° ice, potassium chloride, solution: — 33.6° ice, magnesium

chloride dodecahydrate, solution: -34.3° , ice, potassium chloride, magnesium chloride dodecahydrate, solution. At -21° , carnallite is formed, being unstable in solution below this temperature, and from this point two curves branch, those for the solid phases (1) carnallite and potassium chloride, (2) carnallite and magnesium chloride. The latter curve has various transition points for the various hydrates of magnesium chloride in the presence of carnallite, these temperatures being different from those for the pure compound. At 152.5° , an upper limiting temperature for carnallite is reached, at which it decomposes into potassium chloride and magnesium chloride tetrahydrate. From the -21° transition point also proceeds the curve for the solid phase carnallite and potassium chloride to the temperature 167.5° , where the carnallite decomposes and melts. From this point to the previous decomposition point at 152.5° is another curve for the equilibrium of carnallite with potassium chloride, and the curve then proceeds as the solubility curve of magnesium chloride tetrahydrate in the presence of potassium chloride to the temperature of 176° , when a transition point to the dehydrated salt is reached. The solubility experiments were carried to 186° , and complete melting in sealed tubes was found to occur at 265° ; no evidence of any compound of the two chlorides other than carnallite was obtained. L. M. J.

Inorganic Chemistry.

Production of Ozone by the Decomposition of Water by Fluorine. By HENRI MOISSAN (*Compt. rend.*, 1899, 129, 570—573).—When fluorine is passed into water cooled at 0° , the liberated oxygen contains from 10 to 12 per cent., or, under the most favourable conditions, as much as 14.39 per cent., of ozone, and is decidedly blue. The proportion of ozone is higher the more rapid the current of fluorine, provided that the water is kept at 0° , and subject to the maximum limit of 14.39 per cent.; it is markedly less if the temperature of the water is allowed to rise. C. H. B.

Hyposulphurous Acid. By ARNOLD NABL (*Monatsh.*, 1899, 20, 679—684).—If dry sulphur dioxide is passed into absolute alcohol in which metallic zinc is suspended, and contained in a flask from which air is excluded, a white precipitate is formed. This is left for a day, filtered, and the operation then repeated. The solution deposits small, microscopical, rhombic needles which, after drying in vacuum to eliminate the alcohol of crystallisation, give figures on analysis agreeing with the formula ZnS_2O_4 . The other product, insoluble in alcohol, appears to be a mixture. R. H. P.

Isomerism of Salts of Ammonium, Hydroxylamine, and Hydrazine. By ALEXANDER P. SABANÉEFF [with A. DSHEWACHOFF, M. EFROSS, Z. GINSBURG, J. LEMKE, M. PROSIN, and A. WLIASSOFF] (*Chem. Centr.*, 1899, ii, 32—33; from *J. Russ. Chem. Soc.*, 1899, 31, 375—383. Compare Abstr., 1898, ii, 577).—The following pairs of

isomeric compounds have been prepared and their molecular weights determined by Raoult's method: (1a) ammonium hydroxylamine hydrogen phosphite, (1b) diammonium hydrogen phosphate; (2a) hydroxylamine dihydrogen phosphite, (2b) ammonium dihydrogen phosphate; (3a) hydroxylamine formate, (3b) ammonium hydrogen carbonate; (4a) hydroxylamine acetate, (4b) ammonium glycolate; (5a) hydrazine oxalate, (5b) hydroxylamine oxamate; (6a) hydrazine succinate, (6b) hydroxylamine succinamate; (7a) hydroxylamine benzoate, (7b) ammonium salicylate; (8a) hydroxylamine *m*-aminobenzoate, (8b) hydrazine salicylate, $\text{C}_6\text{H}_4\text{O} \text{---} \text{CO}_2 \text{---} \text{N}_2\text{H}_6$.

(2a) is a syrup which, with absolute alcohol, yields hydroxylamine phosphate. (3a) crystallises in needles, and is easily soluble in water, forming an acid solution which decomposes on boiling, and does not then give the hydroxylamine reaction. (4b) is prepared by mixing glycollic acid with the calculated quantity of ammonia and evaporating in a vacuum; if an excess of ammonia is used, diammonium glycolate is formed; it separates in needles, is easily soluble in water, giving an acid solution from which the acid salt is obtained on evaporating. (5a) crystallises in needles, and is very slightly soluble in water. (5b) forms crystals, and is easily soluble in water. (6a) separates in very perfect crystals, and is soluble in water. (6b) gradually changes into hydroxamic acid; the same change is brought about by boiling the solution. (7a) is very slightly soluble in water. (7b) separates as the anhydrous salt when aqueous solutions of ammonia and salicylic acid are mixed and heated. (8a) is very slightly soluble in water, but more so in alcohol. (8b) is prepared from salicylic acid and hydrazine hydroxide. (2a), (3a), (4a), (5b), (6b), (7a), and (8a) are prepared from the barium salts of the corresponding acids and the sulphates of the nitrogen bases. Whilst measuring the electrical conductivity of hydrazine sulphate, its oxidation by platinum black was observed, and when oxygen is passed into an aqueous solution in which platinum black is suspended, the sulphate is completely oxidised, nitrogen, ammonium sulphate, sulphuric acid, and water being formed. E. W. W.

Action of Potassammonium on Arsenic. By C. HUGOT (*Compt. rend.*, 1899, 129, 603—605).—The action of excess of potassammonium on arsenic yields a brick-red compound, AsK_3NH_3 , analogous to that previously obtained from sodammonium (*Abstr.*, 1899, ii, 151), and when this is heated at 300° in a vacuum, it yields a black compound, AsK_3 . When the arsenic is in excess, the product is an orange solid, $\text{K}_2\text{As}_4\text{NH}_3$, which, when heated a little below 300° , yields a cinnabar-red compound, K_2As_4 . C. H. B.

The Atomic Weight of Boron. By HENRI GAUTIER (*Compt. rend.*, 1899, 129, 595—598).—Boron sulphide, B_2S_3 , prepared by the action of dry hydrogen sulphide on dry amorphous boron at a red heat, was decomposed by sodium hydroxide solution, oxidised with bromine water, and precipitated with barium chloride. Four experiments give $B = 11.041$ with a probable error ± 0.017 .

Boron carbide prepared in the electric furnace by the action of

sugar-charcoal on amorphous boron in presence of copper, was decomposed by chlorine, and the residual carbon weighed as such, and also in the form of carbon dioxide. Two experiments give $B = 10.997$.

C. H. B.

Atomic Weight of Boron. By HENRI GAUTIER (*Compt. rend.*, 1899, 129, 678—681. Compare Abrahall, *Trans.*, 1892, 61, 650; Ramsay and Aston, *Trans.*, 1893, 63, 207; Rimbach, *Abstr.*, 1893, ii, 207).—Boron tribromide, obtained by passing pure bromine over pure boron heated to a dull red heat, was fractionally distilled alone, and then finally over reduced silver, when it distilled quite constantly at 90.5° . Pure boron trichloride was obtained in a similar manner. A weighed quantity of the boron haloid was decomposed by water, and the halogen determined as silver haloid. The mean value obtained for the atomic weight of boron by nine experiments on the decomposition of the bromide was 11.021, with a probable error of ± 0.006 , and from five experiments on the chloride, 11.011, with a probable error of ± 0.008 . The mean of these values is 11.016, a number which the author adopts for the atomic weight of boron in preference to the values obtained by analysis of boron sulphide and boron carbide (compare preceding abstract).

H. R. LE S.

Graphite. By LUDWIG STAUDENMAIER (*Ber.*, 1899, 32, 2824—2834. Compare *Abstr.*, 1898, ii, 96; 1899, ii, 481).—When graphitic acid is heated with sulphuric acid and water at 180° , it gives an insoluble *pyrographitic acid*, which retains the form and appearance of the original graphite. When oxidised with nitric acid, this gives a soluble product containing mellitic acid, a red substance soluble in ether, a dark brownish-red substance soluble in alcohol, and a black residue insoluble in alcohol or ether. When treated with a mixture of fuming nitric acid and potassium chlorate, unlike ordinary pyrographitic acid, it gives a transparent, yellowish-green *pseudo-graphitic acid*; this resembles graphitic acid but is more soluble, less stable, and more readily oxidised; it gives a black reduction product with stannous chloride.

T. M. L.

Treatment of Lepidolite. By JULIUS FORMÁNEK (*Chem. Centr.*, 1899, ii, 11—12; from *Oesterr. Chem. Zeit.*, 2, 309—312).—In order to obtain caesium and rubidium compounds from lepidolite, the finely powdered mineral is decomposed with concentrated sulphuric acid in an iron pan, and the solution evaporated in a lead vessel. The residue is taken up with water, and the potassium, caesium, and rubidium alums which separate are crystallised from water several times, and then treated with barium hydroxide. The excess of the baryta and most of the alumina are removed by means of carbon dioxide, and the solution, after neutralising with oxalic acid, is evaporated until crystals begin to form. Most of the potassium salt separates on cooling, and the rest is removed from the residue by fractional crystallisation, the caesium and rubidium salts being afterwards separated by the same means.

E. W. W.

Commercial Calcium Carbide. By HENRI MOISSAN (*Bull. Soc. Chim.*, 1899, [iii], 21, 865—871).—Theoretically, 1 gram

of calcium carbide should yield 349 c.c. of acetylene, the amounts obtained from seven commercial samples varied from 292.8—318.7 c.c.; three inferior specimens, which were grey and porous, instead of having a fused, crystalline structure, gave only 228.6, 250.4, and 260.3 c.c. respectively. The gas sometimes contains notable quantities of ammonia, and several specimens of carbide yielded a little hydrogen phosphide. To facilitate the study of the insoluble residue, the carbide was decomposed with an aqueous solution of sugar, whereby the lime produced is kept in solution. The residue consists principally of the silicides of carbon, calcium, and iron, sometimes mixed with a little graphite and calcium sulphide; dilute (10 per cent.) hydrochloric acid extracts iron, lime, and small quantities of aluminium and phosphorus; the concentrated acid dissolves further quantities of lime and silica, whilst carbon silicide and graphite remain unattacked. The various forms in which these impurities exist were recognised by microscopical examination. The *silicon* occurs chiefly as carbon silicide, but small quantities of calcium silicide, silica, and a compound containing iron, carbon, and silicon are also formed. Silicon hydride, from the decomposition of calcium silicide, is often evolved in the treatment with concentrated hydrochloric acid. The total *sulphur* in three samples of carbide was found to be 0.37, 0.43, and 0.74 per cent.; it exists as calcium sulphide and aluminium sulphide. Hydrogen sulphide is not liberated when impure calcium carbide is decomposed by water, since it is retained by the calcium hydroxide formed in the reaction; traces of a volatile organic compound containing sulphur seem, however, to be formed in some cases, since the gas, after being washed with potash and lead acetate solution, yields a small quantity of sulphuric acid when burnt. Iron is found as silicide and carbo-silicide. Phosphorus occurs chiefly as calcium phosphide, but is also found combined with iron and silicon. Carbon is sometimes found as graphite retaining calcium and silicon; none was detected in the form of diamond.

N. L.

Action of Magnesium on Saline Solutions. By DONATO TOMMASI (*Bull. Soc. Chim.*, 1899, [iii], 21, 885—887).—When magnesium wire is placed in a solution of potassium chloride, the metal is converted into hydroxide, with liberation of hydrogen; the potassium chloride simply favours the oxidation of the magnesium, and is not itself decomposed. With ammonium chloride solution, a vigorous reaction occurs, hydrogen is evolved, and ammonium magnesium chloride formed. A 30 per cent. solution of calcium chloride attacks magnesium, slightly in the cold and more readily on heating, with the formation of magnesium hydroxide and hydrogen, but a saturated solution is without action unless the metal is finely divided and the liquid heated. A 30 per cent. solution of magnesium chloride has very little action on magnesium, but the boiling solution is easily decomposed by a magnesium-platinum couple, with the formation of magnesium hydroxide and oxychloride. The action on magnesium of solutions of various other salts was examined, and the products of the reactions, in addition to hydrogen, were found to be as follows. Sodium and lithium chlorides: magnesium hydroxide. Barium and strontium

chlorides: scarcely any action on magnesium. Cupric chloride: cuprous chloride, copper oxychloride, and magnesium chloride. Cadmium chloride: cadmium oxychloride, metallic cadmium, and magnesium chloride. Cobalt chloride: cobalt hydroxide and magnesium chloride. Lead chloride: lead oxychloride, metallic lead, and magnesium chloride. Mercuric chloride: mercurous chloride, mercury oxide, and magnesium chloride. Ferric chloride: ferric hydroxide, ferric oxychloride, and magnesium chloride; ferric chloride is not reduced by magnesium. Chromic chloride: chromium hydroxide and magnesium chloride. Platinic chloride: metallic platinum and magnesium hydroxide. Gold chloride: metallic gold, magnesium hydroxide, and magnesium chloride. Copper sulphate: metallic copper, cuprous hydroxide, basic copper sulphate, and magnesium sulphate; at 0° , cuprous hydroxide only is obtained. Zinc sulphate: metallic zinc, zinc hydroxide, basic zinc sulphate, and magnesium sulphate. Ferrous sulphate: ferrous hydroxide, and magnesium sulphate. Manganese sulphate: manganese hydroxide and magnesium sulphate. N. L.

Anhydrous Magnesium Carbonate. By RODOLPHE ENGEL (*Compt. rend.*, 1899, 129, 598—600).—When magnesium ammonium carbonate is gradually heated in a current of dry air at a temperature not exceeding 130° — 140° , it yields anhydrous magnesium carbonate which differs from the natural mineral, and from the carbonate prepared by Senarmont, but resembles that obtained by the action of heat on magnesium potassium sesquicarbonate (*Abstr.*, 1886, 821). It retains the crystalline form of the double carbonate, is very hygroscopic, sets like plaster when mixed with water, and absorbs almost instantly about 100 times its own volume of ammonia gas.

Attempts to prepare an ammonium magnesium sesquicarbonate gave negative results, and the compound, $\text{MgCO}_3 \cdot \text{NH}_4\text{HCO}_3 + 4\text{H}_2\text{O}$, ascribed to Favre, was never described by him. C. H. B.

Dicarbonyl Cuprous Chloride. By WILLIAM APP JONES (*Amer. Chem. J.*, 1899, 22, 287—311).—Carbonic oxide is not absorbed by dry cuprous chloride, but in presence of sufficient hydrochloric acid to form a thin paste, an amount of gas is absorbed at 0° which corresponds with the formation of *dicarbonyl cuprous chloride*, $\text{Cu}_2\text{Cl}_2 \cdot 2\text{CO} + 4\text{H}_2\text{O}$; on adding ice-water, white plates having this composition separate which rapidly decompose in the air. The compound prepared by passing carbonic oxide into cuprous chloride in presence of water or dilute hydrochloric acid ($1\text{HCl} : 2\text{H}_2\text{O}$) is not decomposed by diminishing the pressure until the latter is reduced to 135—125 mm., when complete decomposition occurs; in presence of concentrated hydrochloric acid, decomposition begins at 410 mm. pressure and gradually increases as the pressure is reduced to 160 mm., when it takes place more rapidly and is complete at 130 mm. pressure. Curves are given showing these results.

On passing carbonic oxide into a solution of cuprous chloride in pyridine at 0° , the compound $2\text{Cu}_2\text{Cl}_2 \cdot 3\text{CO}$ appears to be formed, but could not be isolated; on raising the temperature, decomposition occurs

regularly, until at 100° it is nearly complete. The results are plotted in the form of a curve.

When oxygen is passed into dicarbonyl cuprous chloride at 0° , the latter is decomposed, giving rise to a small quantity of carbon dioxide; the formation of this cannot be due to increased activity of the oxygen brought about by the cuprous chloride undergoing oxidation, and thus splitting the molecular into atomic oxygen, for when a mixture of oxygen and carbonic oxide is passed through ferrous sulphate or chloride these compounds are oxidised, but no carbon dioxide is formed.

In discussing the decomposition of dicarbonyl cuprous chloride by reducing the pressure or raising the temperature, it is pointed out that this takes place similarly to that of compounds the "atomic" nature of which cannot be doubted; its properties are compared with those of other inorganic compounds containing carbonic oxide, and the conclusion is reached that it must be regarded as a true chemical compound.

The behaviour of dicarbonyl cuprous chloride with oxygen, chlorine, hydrogen, and nitrogen shows that, at the moment of its liberation from the compound, carbonic oxide possesses no increased chemical activity.

W. A. D.

Spectroscopic Analysis of Neodymium and of Praseodymium. By WILHELM MUTHMANN and L. STÜTZEL (*Ber.*, 1899, 32, 2653—2677. Compare Abstr., 1898, ii, 518; von Scheele, Abstr., 1898, ii, 519; 1899, ii, 291; Bettendorf, Abstr., 1890, 851).—According to Crookes' "one band one element" theory, praseodymium must contain 37 different elements, whereas according to von Scheele the substance is homogeneous. The authors themselves consider that the composite nature of praseodymium is probable, although not established, and that even if true the separation of the constituents, on account of the similarity in their chemical behaviour, presents an almost impossible task. Specimens of praseodymium from Bastnäs cerite and from Australian and Brazilian monazite have been compared with Shapleigh's preparations and no differences have been detected. The composite nature of neodymium is even still more in doubt, as, so far, pure neodymium has not been obtained; the product obtained by the sulphate method of separation contains 2 per cent. of praseodymium. A new separation by the aid of the chromates is quicker, and it is hoped will give better results.

Neodymium has the most complex absorption spectrum of all the earths, the number of bands in neutral chloride solution being 24. All these are not necessarily visible at the same time; in certain concentrated solutions, the six yellow bands become one, similarly for the green; on dilution, several groups disappear completely, particularly the narrow bands at the red end of the spectrum.

Numerous instances of change in the configuration of bands of the rare earths are known, but the causes have not been determined. A notable instance is found in the case of praseodymium; ordinary didymium gives the blue line λ 469 of praseodymium as a well-defined, not over broad, absorption band; when the earth is fractionated by Welsbach's

method, the line loses in intensity, broadens and moves towards the violet end of the spectrum; on further fractionation, the band becomes smaller and more intense, but even in the purest specimens is never so sharp as in the crude didymium.

Bunsen (*Annalen*, 1866, 123, 190) pointed out that the bands in the spectra of didymium salts vary considerably, according to the nature of the acid constituent. Further variations have been found in the case of both praseodymium and neodymium. Neodymium nitrate and chloride give different absorption spectra, especially in the green part of the spectrum; the nitrate in dilute nitric acid gives a single pale band about $\lambda = 522$, whereas in the chloride there are two bands, 525.5 and 521.5, and a pale band 520.5; the yellow bands in the chloride are sharper than in the nitrate.

Still greater differences are observed when the spectra of salts derived from carboxylic acids are examined. A solution of carbonate, probably containing the metal as the hydrogen carbonate, has not the characteristic dark red colour of the nitrate, but a fairly intense blue, due to the fact that the yellow absorption band has increased considerably in intensity, whilst the violet band λ 432—424 has completely disappeared; the green bands are more pronounced than in the nitrate, and all bands are some 7.5 λ nearer the red end of the spectrum, and, in addition, a new orange band, $\lambda = 600.5$, has made its appearance.

Somewhat similar differences have been observed in the case of praseodymium, not merely does the relative luminosity of the bands vary with different salts, but also the order in which the lines disappear on diluting the solutions.

It is obvious that the absorption spectrum is not simply dependent on the molecular weight of the anhydrous salt, as Bunsen suggested.

The authors have employed a spectroscopic method for the estimation of praseodymium and neodymium, although, according to Schottländer (*Ber.*, 1892, 25, 569), this method is inapplicable. The observations were made with a special Krüss apparatus, and in calculating the results, Vierordt's equation, $A = c / -\log J$, was employed, where A = constant, c = concentration, and J = intensity of light after passing through a 10 mm. layer of the solution when the original intensity of the light = 1.

In the following minerals—orthite from Miask, cerite from Riddarhyttan, and orthite (allanite) from Llano Co., Texas, it was found that the percentage of neodymium was practically twice that of praseodymium. J. J. S.

Radio-active Barium Salts and Polonium. By FRITZ GIESEL (*Ann. Phys. Chem.*, 1899, [ii], 69, 91—94).—The author has independently obtained from uranium ores other than pitchblende a substance, consisting chiefly of barium sulphate, which emits Becquerel rays. The substance is similar to that obtained by P. and S. Curie, according to whom it contains an active element radium.

Freshly crystallised barium salts containing radium are only slightly active, but in the course of a few days or weeks the activity increases to a maximum; the portions which crystallise first are more active than

those subsequently obtained from the mother liquor. The chloride, bromide, and iodide phosphoresce without any previous illumination, especially when anhydrous; in moist air, they gradually lose this property, but renewed heating restores it to them. The stronger the phosphorescence of any particular specimen, the feebler is the emission of Becquerel rays. Barium platino-cyanide, prepared from active barium chloride and potassium platino-cyanide, shows strong, spontaneous phosphorescence, which grows less intense as time goes on, the green colour of the double salt changing to yellow and finally to brown. By dissolving and crystallising the brown product, the green salt can again be obtained. The active constituent of the barium salts has not been isolated, and it seems impossible to effect a separation by fractional crystallisation alone.

Strongly active products containing polonium are also being investigated. Hydrogen sulphide produces in them a precipitate which surpasses in activity the best barium salt preparation. The chloride prepared from this sulphur compound is equally effective, as is also the metal deposited from the chloride solution by metallic zinc or an electric current.

The penetrating power of polonium rays is much less than that of radium rays, and consequently the shadow produced by a hard or metallic object is much sharper and deeper with the former than with the latter.

J. C. P.

A New Radio-active Substance. By A. DEBIERNE (*Compt. rend.*, 1899, 129, 593—595).—The constituents of pitchblende which are not precipitated by hydrogen sulphide from an acid solution, but are precipitated by ammonia or ammonium sulphide, include a small quantity of a substance which emits radiations capable of acting on a photographic plate, making barium platino-cyanide phosphorescent and accelerating the discharge of electrified bodies. Apart from its radio-activity, which seems to be about 100,000 times as great as that of uranium, it resembles titanium in general properties. It differs from radium in not being luminescent.

C. H. B.

Mineralogical Chemistry.

Dopplerite. By C. CLAESSEN (*Jahrb. f. Min.*, 1899, i, Ref., 424; from *Chem. Zeit.*, 1898, 523).—Analysis of dopplerite from an Oldenburg moor gave:

C.	H.	O.	Ash.	Total.
52.96	4.67	34.10	8.27	100.00

L. J. S.

New Zealand Coal and Ambrite; Barbados Manjak. By P. PHILLIPS BEDSON (*Trans. Fed. Inst. Mining Eng.*, 1899, 16, 388—390).—Coal from New Zealand gave analysis I (by A. Dodds); the composition of the dried ash-free coal is given under Ia; 10—13 per cent.

of the coal is soluble in pyridine. Ambrite, a brown, transparent resin, associated with this coal, gave II (Dodds). An asphalt from Barbados, locally known as manjak, gave III (by R. L. Treble); it resembles albertite in appearance, but is completely soluble in pyridine.

	Fixed carbon.	Volatile matter.	Moisture.	Ash.	S.
I.	46.44	47.80	4.66	1.10	0.54
II.	—	—	0.59	0.18	—
III.	36.52	61.90	—	1.58	—

	C.	H.	O.	N.
Ia.	74.32	5.67	20.01	
IIa.	80.95	9.87	9.18	—
IIIa.	81.18	8.43	10.39	—

L. J. S.

Identity of Binnite with Tennantite : Composition of Fahlerz. By GEORGE T. PRIOR and LEONARD J. SPENCER (*Min. Mag.*, 1899, 12, 184—213).—The small, brilliant crystals of "binnite" are of rare occurrence in the white, saccharoidal dolomite of the Binnenthal in Switzerland. They are cubic and hexakistetrahedral, and the formula usually assigned to them is $3\text{Cu}_2\text{S}, 2\text{As}_2\text{S}_3$. It is now shown that they are crystallographically, physically and chemically identical with the less perfectly developed crystals of Cornish tennantite. Analysis I was made on eleven crystals (weighing 0.3101 gram), of which the streak is chestnut-brown; thin splinters are translucent and crimson by transmitted light. This analysis gives the formula $3\text{Cu}_2\text{S}, \text{As}_2\text{S}_3 = \text{Cu}_3\text{AsS}_3$. Analysis II is of crystals, of which the streak is black, and which, in thin splinters, are opaque; formula $[3(\text{Cu}, \text{Ag})_2\text{S}, \text{As}_2\text{S}_3] + \frac{1}{15}[6\text{FeS}, \text{As}_2\text{S}_3]$. The variation in the colour of the streak of the mineral depends on the amount of iron present.

Analyses I—V by G. T. Prior. In each case, detailed descriptions are given of the crystallographic and physical characters and of the associations of the material analysed.

	Cu.	Ag.	As.	Sb.	Bi.	Fe.	Zn.	Pb.	S.	Total.	Sp. gr.
I. 49.83	1.87	19.04	—	—	—	1.11	—	0.17	27.60	99.62	4.62
II. 44.12	4.77	[20.49]	—	—	—	3.68	—	—	26.94	100.00	4.598
III. 45.39	—	trace	28.85	—	—	1.32	—	0.11	24.48	100.15	4.921
IV. 41.55	—	trace	28.32	0.83	—	1.02	2.63	0.62	24.33	99.30	4.969
V. 30.56	15.26	trace	27.73	—	—	3.51	trace	0.05	23.15	100.26	5.047

The results of these analyses of "binnite," as well as the published analyses of Cornish tennantite, differ considerably from the figures required by the accepted formula for fahlerz (tetrahedrite and tennantite), namely, $4\text{R}''\text{S}, \text{R}'''\text{S}_3$, where $\text{R}'' = \text{Cu}, \text{Ag}, \text{Fe}, \text{Zn}$, and $\text{R}''' = \text{As}, \text{Sb}, \text{Bi}$. Very few of the published analyses of fahlerz agree with this formula, and minerals which have given the formula $3\text{R}''\text{S}, \text{R}'''\text{S}_3$, have often received new names. Three new analyses were therefore made of specially pure tetrahedrite crystals free from copper pyrites, blende and pyrites which are usually so intimately associated with fahlerz; the fracture of these crystals was smooth and conchoidal and with a brilliant lustre.

Analysis III is of material from a large crystal of octahedral habit from "Fresney d'Oisans, Dauphiné"; the streak is dark brown; after deducting the iron as pyrites, the formula is $3\text{Cu}_2\text{S}, \text{Sb}_2\text{S}_3 = \text{Cu}_3\text{SbS}_3$. Analysis IV is of the well-known brilliant crystals from Horhausen, in Rhenish Prussia; very thin flakes are crimson by transmitted light, and the streak is dark brown. Analysis V is of tetrahedral crystals, probably from Wolfach, Baden; the streak is black. IV and V give the formula $[3(\text{Cu}, \text{Ag})_2\text{S}, \text{Sb}_2\text{S}_3] + \frac{1}{10}[6(\text{Fe}, \text{Zn})\text{S}, \text{Sb}_2\text{S}_3]$.

These analyses suggest the new formula $3\text{R}'_2\text{S}, \text{R}'''\text{S}_2 + x[6\text{R}''\text{S}, \text{R}'''\text{S}_2]$, where $\text{R}' = \text{Cu}, \text{Ag}$; $\text{R}'' = \text{Fe}, \text{Zn}$; $\text{R}''' = \text{As}, \text{Sb}, \text{Bi}$; and x is a small fraction, often $= \frac{1}{10}$ and $\frac{1}{2}$, but rising to $\frac{1}{3}$ in the case of the highly ferriferous tetrahedrite "coppite." In this formula, the group $(\text{Fe}, \text{Zn})_6\text{S}_6$, and not $(\text{Fe}, \text{Zn})_3\text{S}_3$, is isomorphous with Cu_6S_6 . Only in those cases where iron and zinc are absent does the simple formula $3\text{R}'\text{S}, \text{R}'''\text{S}_2$ hold good.

Numerous previous analyses are discussed and found to agree with the new formula.
L. J. S.

Melonite (?), Coloradoite (?), Petzite and Hessite. By WILLIAM F. HILLEBRAND (*Amer. J. Sci.*, 1899, [iv], 8, 295—298).—*Melonite*?—Impure material from the Melones mine, in the Mother Lode region, California, gave the results under I; after deducting a little hessite and tellurium, this gives the formula NiTe_2 . In colour and cleavage, the material agrees with Genth's melonite from the same locality; Genth, however, gave the formula Ni_3Te_3 .

Coloradoite?—One small specimen from the Norwegian mine in the same district showed dolomite, petzite, hessite, and a mercury telluride, which is probably coloradoite.

Petzite.—Analysis of pure material from the Norwegian mine gave II, agreeing with the formula $\text{Au}_2\text{Te}, 3\text{Ag}_2\text{Te}$.

Hessite.—Material from San Sebastian, Jalisco, Mexico, gave analysis III; sulphur, iron and zinc are also present.

	Te.	Ni.	Ag.	Au.	Se.	Mo.	Pb.	Total.	Sp. gr.
I.	80.75	18.31	0.86	—	—	—	—	99.92	—
II.	33.21	—	41.87	25.16	trace	0.08	—	100.32	8.925.
III.	36.11	—	61.16	—	—	—	1.90	99.17	8.24.

L. J. S.

Langbeinite from the Punjab Salt Range. By FREDERICK R. MALLEY (*Min. Mag.*, 1899, 12, 159—166).—A potassium magnesium sulphate occurring as a lenticular stratum in the 'kallar' (impure rock salt) of the Mayo mines, Punjab, India, was discovered and analysed in 1873. The material has now been more completely examined, and found to be the same as the cubic mineral langbeinite, $2\text{MgSO}_4, \text{K}_2\text{SO}_4$, recently described from the Prussian salt deposits (*Abstr.*, 1898, ii, 168).

The Indian mineral is associated with salt, sylvite and kieserite, and sometimes encloses these. It is colourless and transparent, and optically isotropic. Sp gr. 2.84; $H = 4$. The powder is slowly but completely soluble in water. Analysis gave:

K ₂ O.	MgO.	SO ₃ .	NaCl.	H ₂ O.	Total.
22.23	19.08	57.27	0.41	0.84	99.83

On exposure to the air, the powder absorbs water, and there is an increase in weight of nearly 57 per cent. ; the decomposition therefore takes place in accordance with the equation : $2\text{MgSO}_4, \text{K}_2\text{SO}_4$ (langbeinite) + $13\text{H}_2\text{O} = \text{K}_2\text{SO}_4, \text{MgSO}_4, 6\text{H}_2\text{O}$ (picromerite) + $\text{MgSO}_4, 7\text{H}_2\text{O}$ (epsomite).

Langbeinite, as isotropic octahedra, may be artificially produced by fusing together magnesium and potassium sulphates in the proper proportions.

L. J. S.

Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XIII. Evaporation of Sea Water at 25°. By JACOBUS H. VAN'T HOFF and W. MEYERHOFFER (*Chem. Centr.*, 1899, ii, 76 ; from *Sitzungsber. Akad. Wiss. Berlin*, 20, 372—383).—The most recent and trustworthy analyses of sea water show that on an average 1000 parts contain NaCl, 47 ; KCl, 1.03 ; MgCl_2 , 7.36 ; and MgSO_4 , 3.57. When sea water is evaporated at 25°, the salts separate out in the following order :—(1) NaCl ; (2) NaCl + $\text{MgSO}_4, 7\text{H}_2\text{O}$ and NaCl + $\text{MgSO}_4, 6\text{H}_2\text{O}$; (3a) NaCl + $\text{MgSO}_4, 6\text{H}_2\text{O}$ + KCl and NaCl + $\text{MgSO}_4, 5\text{H}_2\text{O}$ + KCl ; (3b) NaCl + $\text{MgSO}_4, 4\text{H}_2\text{O}$ + $\text{MgCl}_2, \text{KCl}, 6\text{H}_2\text{O}$; (4) NaCl + $\text{MgSO}_4, 4\text{H}_2\text{O}$ + $\text{MgCl}_2, \text{KCl}, 6\text{H}_2\text{O}$ + $\text{MgCl}_2, 6\text{H}_2\text{O}$, and in the following relative quantities :

	NaCl.	MgSO_4 .	KCl.	MgCl_2 .	$\text{KCl}, 6\text{H}_2\text{O}$.	MgCl_2 .
1.	94.5					
2.	2.39	1.63				
3a.	0.59	1.42	0.72			
3b.	0.50	0.22		1.27		
4.	0.02	0.30		0.07	6.02	

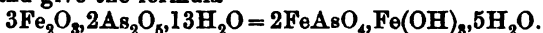
These quantities, however, are only obtained when the separate crystallisations are removed from the mother liquor.

E. W. W.

Pharmacosiderite. By ERNALD G. J. HARTLEY (*Min. Mag.*, 1899, 12, 152—158).—The formula of pharmacosiderite is uncertain ; it is based on an analysis by Berzelius (1824), and no analysis has since been made. The present analyses were made on selected green crystals from Cornwall ; sp. gr. 2.798. A green crystal placed in ammonia solution very soon becomes red throughout without alteration of the optical characters ; on placing such a red crystal in dilute hydrochloric acid, the green colour is restored to the whole crystal. Two preliminary analyses (I and II) show a deficit, which was afterwards found to be due to the presence of potassium. This element is present in all the Cornish specimens examined, but in variable amount (2.68 and 4.12 per cent. K_2O), and in two specimens from Hungary only traces were found. About 10 per cent. of water is lost at 100° ; at 130°, the crystals begin to turn brown and opaque, and about 14.18 per cent. is lost ($=5\text{H}_2\text{O}$ in the formula given below). A complete analysis made on another specimen is given under III.

	As_2O_5 .	P_2O_5 .	Fe_2O_3 .	K_2O .	H_2O .	Total.
I.	37.53	2.04	39.29	—	19.63	98.49
II.	36.85	2.06	38.61	—	[19.63]	97.35
III.	37.16	1.20	37.58	4.54	18.85	99.33

The ratios between the iron, arsenic acid and water are fairly constant, and give the formula



The potassium is assumed to replace hydrogen in the hydroxyl, and the formula is finally written as $2\text{FeAsO}_4, \text{Fe}[\text{O}(\text{H}, \text{K})]_3, 5\text{H}_2\text{O}$. L. J. S.

[Chabazite] from North Carolina. By JULIUS H. PRATT (*Jahrb. f. Min.*, 1899, i, Ref. 229—231; from *Jour. Elisha Mitchell Sci. Soc.*, 1897, 14, 61—83).—Analyses by C. Baskerville are given of the small crystals of chabazite associated with wellsite (Abstr., 1897, ii, 565) in the Buck Creek corundum mine, Clay Co., North Carolina. The simple and twinned rhombohedra occur on felspar, hornblende and corundum. The material for analysis was separated into two portions by means of a heavy liquid; anal. I on material of sp. gr. 2.147—2.203; II of sp. gr. 2.203—2.244.

	SiO ₂ .	Al ₂ O ₃ .	FeO.	CaO.	BaO.	MgO.	K ₂ O.	Na ₂ O.	H ₂ O.	Total.
I.	45.08	19.68	2.00	7.22	0.18	0.23	4.34	3.35	18.00	100.08
II.	46.15	20.74	2.00	6.92	0.24	0.22	4.10	3.35	16.30	100.02

This variation in composition and specific gravity supports Streng's hypothesis as to the composition of chabazite.

Other minerals from North Carolina, described in this paper, have already been noticed (Abstr., 1898, ii, 342, 606). L. J. S.

Constitution of Pectolite, Pyrophyllite, Hemimorphite and Analcite. By FRANK W. CLARKE and GEORGE STEIGER (*Amer. J. Sci.*, 1899, [iv], 8, 245—257).—In continuing the investigation of the constitution of natural silicates, special importance is attached to the two following reactions: (1), when talc is ignited there is a liberation of one-fourth of the silica (Abstr., 1890, 948); this suggests that other acid metasilicates may behave in a similar way; (2), dry ammonium chloride, at its temperature of dissociation, acts differently on different minerals (Abstr., 1892, 772).

Pectolite.—The material used in the experiments was from Bergen Hill, New Jersey; analysis gave the results under I, agreeing with the accepted formula $\text{HNaCa}_2\text{Si}_2\text{O}_6$. Only a small portion of the water is given off below a dull red heat. After igniting the mineral, sodium carbonate solution takes up 8.68 per cent. of silica, or one-sixth of the total amount. This, it is considered, indicates that the mineral is an acid metasilicate as expressed by the above formula. Before ignition, sodium carbonate solution, or even distilled water, has a slow, decomposing action on the mineral, both silica and bases being withdrawn; the action is, however, not one of simple solution.

Pyrophyllite.—The material used was from Deep River, North Carolina, and gave the results under II. The empirical formula, AlHSi_2O_6 , is apparently that of an acid metasilicate, but after ignition, only about 2 per cent. of silica is liberated. The formula is therefore written as $\text{OH} \cdot \text{Al} : \text{Si}_2\text{O}_5$, that is, as a basic salt of the acid $\text{H}_2\text{Si}_2\text{O}_5$. The mineral is very slightly attacked when heated with dry ammonium chloride.

Hemimorphite.—White material from Franklin, New Jersey, gave the results under III. The formula generally accepted represents the

mineral as a basic metasilicate, $\text{SiO}_3(\text{Zn}\cdot\text{OH})_2$. Here the hydrogen is all combined in one way, and so, too, is the zinc. In all other possible formulæ, the hydrogen, as well as the zinc, must be represented as present in at least two modes of combination. Several experiments were made with the idea of extracting a definite fraction of the zinc or water, but the results were negative and only tend to support the usual formula. Water and sodium carbonate solution have very little action either before or after ignition of the mineral. By heating with dry ammonium chloride, all the zinc is converted into zinc chloride.

Analcite.—Crystals from Wasson's Bluff in Nova Scotia gave analysis IV. The water is lost as follows :

Temperature.	100°.	180°.	260°.	300°.	Low redness.	Full redness.	Blast.	Total.
H ₂ O per cent.	0·58	1·16	3·64	1·57	1·90	0·11	nil	8·96

Before or after ignition very little silica is extracted by sodium carbonate solution. Heated at 350° with dry ammonium chloride, about half of the sodium is converted into chloride, and ammonia is retained ; this ammonia is not given off when the residue is warmed with caustic sodium solution. The composition of the residue, after extracting sodium chloride, is given under V, which agrees approximately with $\text{H}_2\text{Na}_2\text{Al}_4\text{Si}_8\text{O}_{24}\cdot\text{NH}_3$. This ammonia derivative suggests that the analcite formula should be quadrupled, namely, $\text{Na}_4\text{Al}_4\text{Si}_8\text{O}_{24}\cdot 4\text{H}_2\text{O}$. G. Friedel has previously shown that the water of analcite may be replaced by ammonia (Abstr., 1896, ii, 481).

An excess of silica over that required by the accepted analcite formula, $\text{NaAlSi}_2\text{O}_6\cdot\text{H}_2\text{O}$, is shown by analysis IV and by some previous analyses. This is explained by analcite being, not a metasilicate, but a mixture of ortho- and tri-silicate, the general formula being $\text{NaAlX}\cdot\text{H}_2\text{O}$, where $\text{X} = n\text{SiO}_4 + m\text{Si}_2\text{O}_8$. This explains the alteration of albite, $\text{NaAlSi}_3\text{O}_8$, and nephelite, NaAlSiO_4 , to analcite. For normal analcite, the formula is finally written as $\text{Al}_4\text{Na}_4(\text{SiO}_4)_2(\text{Si}_2\text{O}_8)_2\cdot 4\text{H}_2\text{O}$. This is written structurally to show the relation between analcite, leucite and the garnet-sodalite group.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	Na ₂ O	H ₂ O	Total.
I.	53·34	0·33	—	33·23	9·11	2·97 ; MnO, 0·45 ; CO ₂ , 0·67	100·10
II.	64·73	29·16	0·49	—	—	5·35 ; TiO ₂ , 0·73 ; MgO, trace	100·46
III.	24·15	0·19		0·12	—	7·95 ; ZnO, 67·55	99·96
IV.	57·06	21·48	0·13	0·16	12·20	8·96	99·99
V.	62·59	24·34	—	0·18	8·11	2·32 ; NH ₃ , 2·46	100·00

L. J. S.

Analysis of Rocks. By ERNST A. WÜLFING (*Ber.*, 1899, 32, 2214—2224).—Analyses are given of four samples of Keuper marl from the neighbourhood of Tübingen ; some were made by the author, the others by Dittrich. The agreement is fairly close, except in the case of alumina and ferric and sodium oxides. The author separated the iron and aluminium by running the nearly neutral solution of the chlorides into excess of a boiling solution of caustic soda (made from the metal), and found more alumina and less ferric oxide than Dittrich, who fused the mixed oxides with pure caustic soda in a silver crucible ; the discrepancy in the sodium is unexplained.

Stress is laid upon the necessity that the reagents used in a rock-analysis, including the distilled water, should be pure. C. F. B.

Experimental Petrology. By K. BAUER (*Jahrb. f. Min.*, 1899, Beil. Bd. 12, 535—580).—In continuing the experiments of Doelter and Schmutz (*Abstr.*, 1897, ii, 54, 329) on the artificial production of rocks, the main object has been to test whether different rocks can be formed from the same magma. Powdered rocks—mica-schist, granite, diorite, phonolite, leucite-lava, nepheline-basalt and andesite, or mixtures having the same composition as these—were fused in a platinum crucible with various fluxes. The following will serve as an example of the several experiments made. A mixture consisting of mica schist, potassium fluoride, sodium fluoride, calcium fluoride, sodium tungstate and potassium tungstate was maintained in a fused condition at 1400° for two hours, in a plastic condition for seven hours, and allowed to cool slowly for five hours. Under the microscope, the product resembled a mica-andesite, and was seen to contain plagioclase, biotite, augite, magnetite, scapolite, nepheline and glass. The same mica-schist with other fluxes gave a product resembling a melilite-basalt. Using diorite with various fluxes, the products were quartz-basalt, andesite, melilite-basalt, mica-andesite and phonolite-pitchstone. Phonolite-pitchstone was also produced from mixtures having the compositions of granite and of phonolite. This is taken to indicate that different rocks may be formed from the same magma, and *vice versa*. [The chemical composition of the magmas have, however, been considerably modified by the large amount of fluxes used.]

Hornblende was formed in three of the fusions, whilst quartz was formed only once. L. J. S.

[**Mineral Analyses**]. By W. TARASSENKO (*Jahrb. f. Min.*, 1899, i, Ref., 458—475; from *Mem. Kieff Naturalists' Soc.* (Russian), 1896, 15, 1—347).—The following mineral analyses are given in a petrological paper on the gabbro and allied rocks in the districts of Radomysl, gov. Volhynia, and Shitomir, gov. Kieff, Russia.

Orthoclase (micropertthite) in a labradorite-rock from Poromowka, Shitomir district, gave anal. I; the material analysed contained spindle-shaped enclosures of plagioclase.

Labradorite from the same rock gave II and III; the former of sp. gr. 2.692—2.686; the latter of sp. gr. 2.686—2.677; this material also contained spindle-shaped enclosures, possibly of orthoclase.

Diallage in a labradorite-rock from Kamenny Brod, Radomysl district, gave IV (also MnO, trace; X, 0.15).

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	CaO.	MgO.	K ₂ O.	Na ₂ O.	H ₂ O.	Total.
I. 62.58	0.59	20.83	—	—	2.10	—	12.24	2.08	0.41	100.33	
II. 54.78	0.36	28.16	0.27	0.48	10.35	—	1.45	4.84	0.04	100.78	
III. 55.32	0.28	28.16	0.05	0.52	10.05	—	0.97	5.20	0.03	100.58	
IV. 50.11	1.01	1.69	1.15	15.61	15.10	18.68	—	—	0.65	99.15	

L. J. S.

Trap-rock of Rocky Hill, New Jersey. By ALEXANDER HAMILTON PHILLIPS (*Amer. J. Sci.*, 1899, [iv], 8, 267—285).—A dyke of dolerite in the Triassic strata at Rocky Hill, New Jersey, shows, in its width of half a mile, variations in chemical composition and in structure. Analysis I is of the microcrystalline rock at the margins; III is of the most coarsely crystalline material towards the centre of the dyke, and II is of an intermediate rock. Analyses are also given of material separated from the rocks by means of heavy solutions. IV and V are of the diallage from the rocks II and III respectively. VI and VII are of felspar (plagioclase) from the rock II, the former of sp. gr. >2.69, and the latter of sp. gr. <2.69. VIII and IX are of felspar, sp. gr. >2.69 and <2.69, from rock III; and X is of felspar (anorthoclase), of sp. gr. <2.60 from the same rock.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	CaO	MgO	Na ₂ O	K ₂ O	P ₂ O ₅	H ₂ O	Total
I.	51.46	1.06	13.98	2.66	8.92	—	10.49	7.59	4.75	—	0.17	—	101.08
II.	50.34	1.56	15.23	2.82	11.17	0.14	9.61	5.81	2.98	1.02	0.20	0.26	101.09
III.	56.78	1.44	14.33	5.76	9.27	0.25	5.26	1.58	3.43	1.75	0.36	0.43	100.64
IV.	47.72	—	3.44	5.93	18.34	—	11.40	12.89	0.86	0.37	—	—	100.95
V.	48.54	—	5.50	2.77	21.25	—	10.97	7.67	3.10	—	—	0.82	100.62
VI.	53.84	—	29.30	0.81	—	—	10.08	0.28	5.31	1.16	—	0.44	101.22
VII.	62.26	—	21.87	0.54	—	—	6.53	0.15	7.98	1.20	—	0.82	100.85
VIII.	66.84	—	17.98	2.60	—	—	4.02	0.48	5.46	1.72	—	0.72	99.82
IX.	71.68	—	15.02	2.48	—	—	3.86	0.12	5.52	1.37	—	—	100.05
X.	66.28	—	16.79	1.60	—	—	0.71	0.13	9.76	5.31	—	0.49	101.07

L. J. S.

Analyses of Italian Volcanic Rocks. By HENRY S. WASHINGTON (*Amer. J. Sci.*, 1899, [iv], 8, 286—294).—Five analyses are given of trachytes from the Phlegrean Fields and from Ischia. L. J. S.

Meteoric Iron from Caperr, Patagonia. By LAZARUS FLETCHER (*Min. Mag.*, 1899, 12, 167—170).—This iron was known before 1869 in the neighbourhood of Caperr, Rio Senguerr, Patagonia. It weighs 114 kilograms, and measures 48 × 31 × 27 cm. The structure is octahedral, and the etched surface shows distinct Widmanstätten figures with kamacite, tænite and plessite. Schreibersite is embedded in the kamacite. No troilite or silicate was seen. Sp. gr. 7.837. Analysis gave:

Fe.	Ni.	Co.	P.	Cr.	Cu.	S.	Total.
89.87	9.33	0.53	0.24	trace	trace	nil.	99.97

In composition and structure, this iron resembles the Joel iron from Atacama. L. J. S.

Cliftonite and Tænite in the Youndegin Meteoric Iron. By LAZARUS FLETCHER (*Min. Mag.*, 1899, 12, 171—174).—Cliftonite is the name given by the author to cubic crystals of graphitic carbon obtained from the meteoric iron found in 1884 in the sub-district of Youndegin, Western Australia. From a fragment weighing 8.32 grams, three milligrams of cliftonite were isolated (Abstr., 1888, 30). More recently, a larger mass (97.25 grams) of the same iron was dissolved in dilute hydrochloric acid, but no cliftonite was seen. The cliftonite is there-

fore localised in one or more parts of the mass, and not uniformly distributed through it.

During the solution of the iron, thin, lustrous, black plates (total weight, 0.0870 gram) were set free; they appeared to be an alloy of nickel and iron belonging to the ténite group. After being kept for eleven years in a weighing tube, the material had increased in weight and altered in character owing to the formation of a layer of magnetic iron oxide on the surface. Sp. gr. 6.75. An analysis shows the material to be ténite, with the composition: Fe, 61.87; Ni(Co), 38.13. Phosphorus, copper and magnesium were also present in small amount.

L. J. S.

Fluorine in the Mineral Waters of Portugal and Spain. By ANTONIO J. FERREIRA DA SILVA and ALBERTO D'AGUIAR (*Bull. Soc. Chim.*, 1899, [iii], 21, 887—890. Compare Abstr., 1899, ii, 501, 602, 675).—The general question of the presence and detection of fluorine in mineral waters is discussed. The Campilho spring at Vidago has been found by one of the authors to contain fluorine equivalent to 0.000942 gram of sodium fluoride per litre, a result which may be compared with the corresponding figures for the Gerez spring (0.02288) and for the Spanish mineral waters of Lugo (0.0242) and Guitiriz (0.0234). According to Gil, the presence of fluorine in many alkaline and sulphurous waters has hitherto been overlooked, owing to the fact that the tests usually applied for this element depend on the formation of hydrogen fluoride, whereas, since silica or silicates are also commonly present, it is rather silicon fluoride which is produced and should be sought for.

N. L.

Physiological Chemistry.

Autodigestion of the Pancreas. By S. PFÖRRINGER (*Virchow's Archiv*, 1899, 158, 126—147).—Previous authors have called attention to the possibility of self-digestion being a cause of pancreatic cysts and necroses. Chiari (*Zeit. Heilk.*, 1896, 17), in particular, has directed attention to the fact that the pancreas is often found partially digested after death, and he considers that this may begin in the last hours of life. The present investigation confirms Chiari's views; it contains records of a hundred autopsies; the pancreas was examined microscopically, and evidence of digestive necrosis was found in forty-five, and this was very marked in eleven cases. The conditions of the patients (age, disease, &c.) appear to be as varied where such necrosis is found as in those cases where it is not found.

W. D. H.

Action of Arginine on the Tryptic Digestion of Proteid. By D. LAWROFF (*Zeit. physiol. Chem.*, 1899, 28, 303—306).—The presence of arginine is helpful to the tryptic digestion of proteid. This appears to be connected with its alkalinity; an equivalent amount of sodium carbonate acts similarly. Arginine, like sodium carbonate, aids the

emulsification of fats; excess of arginine, as of sodium carbonate, is harmful.
W. D. H.

The Fluorine in Tooth- and Bone-ash. By HEINRICH HARMS (*Zeit. Biol.*, 1899, 38, 487—498).—Fresenius' method with certain small modifications is well adapted for the detection of quite minimal quantities of fluorine. The amount of fluorine in bones and teeth as given by Carnot, T. Wilson, and Gabriel is much too great. The amount varies from 0.022 to 0.005 per cent. The variations in the amount of fluorine, as compared with the other constituents of the ash, which are fairly constant, show that the fluorine is not chemically combined with these, but is rather an accessory constituent; this view is confirmed by the presence in the bone of microscopic crystals of calcium fluoride.
W. D. H.

Composition of the Cartilage of the Shark. By GUSTAV VON BUNGE (*Zeit. physiol. Chem.*, 1899, 28, 300—302).—The cartilage removed from the fish *Scymnus borealis*, which had been packed in ice, gave the following analytical results: water, 92.8 per cent.; organic material, 5.9; inorganic material, 1.3.

Of the inorganic material, sodium and chlorine were the most abundant constituents; details are also given of the other inorganic constituents.

Petersen and Soxhlet (*J. pr. Chem.*, 1873, [ii], 7, 181) state that the fresh cartilage contains 16.7 per cent. of sodium chloride; their specimen, however, had been packed in salt.
W. D. H.

Substances present in the Liver which are converted into Sugar by Acids. By JOSEF SEEGEN (*Chem. Centr.*, 1899, ii, 58; from *Centr. Physiol.*, 13, 115—120. Compare *Abstr.*, 1898, i, 619).—After liver-extract has been heated with hydrochloric acid, more sugar is found than corresponds with the sugar and glycogen contained in the extract. The substance prepared from liver-extract by means of 90 per cent. alcohol contains nitrogen, reduces alkaline copper solutions, and, when heated with acids, yields a sugar with reducing properties, but the quantity so obtained is far too little to account for the excess of sugar formed from the extract by acid, hence the liver must contain yet another compound which is easily converted into sugar. The carbohydrate groups of the albumin are supposed to be affected by the action of the liver in such a way that they easily form sugar by the action of hydrochloric acid.

E. W. W.

Amount of Urea in the Liver. By RUDOLF GOTTLIEB (*Chem. Centr.*, 1899, i, 1298; from *Arch. exp. Path. Pharm.*, 42, 238—249).—See this vol., ii, 57.

Human Bile. By RICHARD VON ZEYNEK (*Chem. Centr.*, 1899, ii, 213—214; from *Wien. klin. Woch.*, 12, 568—569).—The quantity of bile secreted in a day amounts to 300—400 grams, containing 7—12 grams of solid matter; it is strongly alkaline, and has a sp. gr. 1.011—1.012. The bile pigments are completely precipitated by basic

lead acetate, but only partially by the normal salt; the bile acids, mucin, and the colouring matter are thrown down by saturating with ammonium sulphate. Only a slight precipitate is formed by supersaturating with magnesium sulphate. Hydrochloric or sulphuric acid gives an amorphous precipitate and the liquid becomes deep green and gradually deposits the bile acids. Bile gives a yellow coloration with alkalis; this is shown best by samples which have become of a greenish tinge by exposure to the air. The precipitate obtained by means of alcohol, when rubbed with glycerol, is capable of converting starch into sugar, but does not digest albumin. The bile secreted by the patient during each hour of a day was examined and found to be of a sp. gr. 1.011 and to contain in 1000 parts, 21.88 of solids, 2.39 of mucin, 13.8 of alkali salts of the bile acids, 8.96 of soluble salts, and 0.23 of insoluble salts. Another sample had a sp. gr. 1.012 and yielded 30.76 of solids, 2.087 of mucin, 18.31 of alkali salts of the bile acids, 0.78 of lecithin, 2.307 of cholesterol and fat, 9.10 of soluble salts, 0.31 of insoluble salts, 0.054 of ammonia and trimethylamine, and 2.087 of acid ethereal extract. On one day when 336.73 grams of bile were secreted, the solid residue amounted to 10.69 grams; the amounts of the former per hour varied from 2.01 to 30.25 grams, and of the latter from 0.054 to 0.99 gram. The ash is principally made up of sodium chloride, the insoluble portion containing traces of iron and copper.

By adding zinc chloride and excess of ammonia to a very dilute aqueous solution of bile, a green coloration is formed in $\frac{1}{2}$ —1 hour, and the liquid shows a characteristic band in the red part of the spectrum about 650 μ wave-length. Human urine containing bile pigments and bilirubin also give this reaction.

E. W. W.

Degradation of Caffeine in the Organism of the Dog. By MARTIN KRÜGER (*Ber.*, 1899, 32, 2818—2824).—On administering 50.5 grams of caffeine during a period of 20 days to a dog which was fed exclusively on flesh, there was found in the urine excreted during this period 7.4 grams of 4:6-dimethylxanthine (theophylline), 6.6 grams of unchanged caffeine, 4.61 grams of 4-methylxanthine, 1.9 grams of 1:4-dimethylxanthine (theobromine), and about the same quantity of 1:6-dimethylxanthine (paraxanthine)—per 100 grams of caffeine originally administered. For the method of separation adopted, the original paper should be consulted. The results obtained show that all three methyl groups of caffeine are attacked simultaneously, and that the group in position 1 offers least resistance to elimination; so that theophylline is the principal initial degradation product of caffeine, just as 4-methylxanthine is the principal product in the case of theobromine (Krüger and Schmidt, following abstract). The small quantity of theobromine obtained, taken in conjunction with Krüger and Schmidt's results, explains why heteroxanthine (1-methylxanthine) is not formed by the degradation of caffeine, and suggests that the 4-methylxanthine isolated owes its origin to theophylline rather than to theobromine. It is pointed out that theophylline and theobromine have hitherto never been isolated in the animal organism, but only from plant extracts.

W. A. D.

Decomposition of Theobromine, Paraxanthine, and 4-Methylxanthine in the Animal Organism. By MARTIN KRÜGER and PAUL SCHMIDT (*Ber.*, 1899, 32, 2677—2682. Compare Albanese, *Abstr.*, 1899, ii, 777).—Bondzynski and Gottlieb's experiments (*Abstr.*, 1895, i, 434) have been repeated. Theobromine, when introduced into the bodies of dogs or rabbits, is excreted in the urine partly in an unaltered condition, but mainly as 1- and 4-methylxanthine. Paraxanthine is converted in the body of rabbits into 6-methylxanthine, identical with that found in human urine. Neither 1-methylxanthine nor xanthine could be isolated.

Although theobromine is converted into 1-methylxanthine in the animal system, attempts to obtain xanthine from 4-methylxanthine were abortive.

The separation of the purine derivatives from urea was accomplished by precipitating them with sodium hydrogen sulphite and copper sulphate; the purine derivatives obtained from the copper precipitate were treated with manganese peroxide in dilute acetic acid solution in order to destroy uric acid (compare *Abstr.*, 1898, i, 699).

J. J. S.

Intestinal Absorption and Saline Cathartics. By GEORGE B. WALLACE and ARTHUR R. CUSHNY (*Pflüger's Archiv*, 1899, 77, 202—209. Compare *Abstr.*, 1898, ii, 442).—Höber (*ibid.*, 74, 346) describes the absorption of saline solutions in the small intestine as depending on purely physical factors. This theory is opposed to the results previously published by the authors; the present paper restates their views, and adds some further confirmatory experiments.

W. D. H.

Passage into the Urine of Chloroform administered by Inhalation. By DIOSCORIDE VITALI (*L'Orosi*, 1899, 22, 145—148).—From the results of tests made on the urine of four patients before and after the administration of chloroform, the conclusion is drawn that chloroform does not pass into the urine. The presence in the urine of organic chlorine compounds produced from the chloroform could not be detected.

T. H. P.

Excretion in Blood-free and in Fasting Frogs. By WACŁAW VON MORACZEWSKI (*Pflüger's Archiv*, 1899, 77, 290—310).—The excreta from a number of normal fasting frogs kept in a clean vessel were collected, and in them the nitrogen, phosphorus, chlorine, ammonia, potassium, sodium, calcium, and magnesium were estimated. The results are given in full and compared with what occurs in frogs whose blood had been replaced by an iso-osmotic solution of sodium chloride; in these animals, which often live a considerable time, the metabolic changes are slow as evidenced by the reduction in the various substances excreted and mentioned above. When sodium nitrate is used instead, the amount of nitrogen is high from the excretion of nitrates, but the amount of potassium and sodium is high also. Sodium acetate is more fatal. Sodium sulphate raises the excretion of nitrogen, but the other substances are diminished, as when sodium chloride is used.

If a urea solution is substituted for the blood, there is an increase in the excretion of nitrogen, and of some of the other substances also. If sugar solution is used, the frogs stand it exceedingly well; all excretion diminishes except that of calcium; this probably depends on the ready solubility of calcium phosphate in solutions of sugar.

Frogs can stand considerable dilution of their blood without interference with nitrogenous metabolism. W. D. H.

Fat of Normal and of Degenerated Heart Muscle. By W. LINDEMANN (*Zeit. Biol.*, 1899, 38, 405—418).—The question always arises in connection with fatty degeneration, whether the fat is produced from proteid in the cells, or whether it has been merely transported from other parts and stored there. The comparison of the heart-fat in cases of fatty degeneration, mostly from cases of anæmia, with that in normal hearts, and with that in other parts of the body, appears to support the former view. The following table summarises the results obtained: column 1 gives the acid number, column 2 the saponification number; column 3 the iodine number, and column 4 the Reichert-Meissl number.

	1.	2.	3.	4.
Degeneration fat	18.35	257.4	108.5	23.9
Normal heart fat	7.3	202.3	61.1	2.0
Kidney and subcutaneous fat ...	3.76	201.8	70.8	0.9

The degeneration fat, in its high saponification number and large percentage of volatile fatty acids, resembles butter fat and the fat in the so-called tears of marine mammalia. W. D. H.

[Physiological Action of] Acetonedicarboxylic Acid and Citric Acid. By LUIGI SABBATANI (*Chem. Centr.*, 1899, ii, 22—23; from *Atti Real. Accad. Torino*, 34).—Experiments on dogs and rabbits show that the stupefying effect of acetone is not shared by citric, acetonedicarboxylic, or acetoacetic acids, which are only injurious in large doses. When acetonedicarboxylic acid is administered to healthy animals, it is partly decomposed in the stomach with liberation of carbon dioxide, but only very small quantities of acetone or of unchanged acid are found in the urine. Citric acid, under similar conditions, does not yield ketonic acids, or at most traces which escape detection in the urine.

Acetone may be separated from acetoacetic acid, ethyl acetoacetate and acetonedicarboxylic acid by the following method. Insoluble bromine compounds, such as ethyl *αα*-dibromoacetate, pentabromoacetone, &c., are precipitated from the urine acidified with sulphuric acid by adding a slight excess of bromine water and allowing the mixture to remain 12 hours. The acetone itself is not attacked, and is distilled from the filtrate after removing the excess of bromine by means of powdered iron. Its amount is then determined by means of Lieben's method of conversion into iodoform. The amount of acetone, together with that derived from the ketonic acids, is similarly estimated in the liquid obtained by directly distilling a second portion of the acidified urine. Acetoacetic acid cannot be separated from ethyl acetoacetate, or acetonedicarboxylic acid by this method. E. W. W.

Chemistry of Vegetable Physiology and Agriculture.

[Effect of Mineral and Nitrogenous Nutritive Matters on the Fermenting Capacity of Yeasts.] By R. KUSSEKOW (*Bied. Centr.*, 1899, 28, 630—632; from *Brenneri-Zeit.*, 1897, 14, Nos. 318—320; and *Centr. Bakt. Parasit.*, 1898, 4, ii, 154).—Addition of superphosphate, potassium phosphate, and magnesium sulphate increases the productive power of yeast in bad mash-material. Yeast distilleries should employ lower mash temperatures, to avoid separation of proteids with phosphates; in thick mash distilleries, the temperatures should be higher in order to separate froth-producing proteids, and to convert peptones and albumoses, as far as possible, into amides.

N. H. J. M.

Yeast. By CARL BÖTTINGER (*Chem. Zeit.*, 1899, 23, 313 and 645).—Solutions of grape sugar (5—6 per cent.) to which yeast was added were treated with lime (0.25 to 2 per cent.), with copper sulphate (0.17—1 per cent.), and with both substances together. In every case, there was a partial or complete destruction of the sugar in a few days, either with or without evolution of gas. With glycollic acid (0.33 per cent.) all the sugar fermented with abundant liberation of carbon dioxide. With glyoxylic acid, the production of carbon dioxide was only slight and soon ceased; further addition of yeast induced renewed liberation of gas, and in 30 days nearly half of the sugar was recovered; oxalic acid was found to be present. Pyruvic acid acts similarly to, but less energetically than, glyoxylic acid, and gives rise to an intense odour of *Lotus*. Further experiments were made with paraldehyde, acetone, acetic acid, benzaldehyde, tartaric, citric, and oxalic acids.

As regards the effect of sugar on the fermentation of grape juice, it was found that addition of 10 per cent. of grape sugar delayed the production of mould. In both cases, evolution of gas was very limited, and on distilling on the 20th day, there was only enough alcohol produced, both with and without sugar, to allow of detection by the iodoform test. The effect of sugar was rather physical than chemical.

N. H. J. M.

A Sugar Bacterium. By H. MARSHALL WARD and JOSEPH REYNOLDS GREEN (*Proc. Roy. Soc.*, 1899, 65, 65—84).—The bacterium occurs along with at least one yeast in a mixture of organisms said to have come from Madagascar, where it occurs as an "excrecence on the sugar cane." The clumps induce vigorous fermentation in sugar solutions (15—20 per cent.), liberating relatively enormous amounts of carbon dioxide and some acid; oxygen is not necessary in any quantity.

The bacterium will practically only grow in presence of sugar, and only certain sugars are suitable: sucrose (after undergoing inversion) is far the best, levulose is utilised to a slight extent, and dextrose is not a favourable medium. Dextrin, maltodextrin, maltose, lactose,

and soluble starch are all unsuitable or useless. Negative results were also obtained with glycerol and yeast extract, starch treated with diastase, potato, carrot, and milk.

In order to throw some light on the rôle of the bacterium and the yeasts respectively in the fermentation produced by the mixed organisms, a number of experiments were made in which different solutions (such as sucrose, a mixture of sucrose and lævulose, dextrose, &c.) were sown with pure cultures of (1) the yeast, (2) the bacterium, (3) the yeast and bacterium separately, and (4) the yeast and bacterium as ordinarily associated. It was found that production of alcohol was due to the yeast alone, the bacterium being without influence. The acid (acetic and succinic) was produced mainly by the bacterium; of the two acids relatively more acetic acid was produced by the bacterium than succinic acid. In sucrose, and in dark brown sugar containing lævulose, the conjoint organism produced less acids than the bacterium alone, whilst in dextrose the contrary was the case.

The presence of the bacterium is of no advantage, but rather disadvantageous to the yeast, whilst the yeast is of use to the bacterium in excreting nitrogenous food. The bacterium does not affect alcohol like ordinary acetifying organisms, and seems to act directly on the sugar with production of acid, the immediate antecedent of which is probably lævulose.

In sucrose, the bacterium produces a viscous material containing two carbohydrates in many respects similar to, but not quite identical with, Scheibler's dextran.

N. H. J. M.

Permanent Forms of Nitric and Nitrous Organisms. By ALFRED BEDDIES (*Chem. Zeit.*, 1899, 23, 645—647).—Sterilised solutions containing the nutritive substances present in manure heaps, the percentage of nitrogen being raised to 3 per cent. by the addition of ammonium sulphate, in which the alkalinity was made suitable by the addition of sodium carbonate or of phosphoric acid, were inoculated with soil. After being kept for several weeks in diffused light at 20—25°, the cultures in which nitrification was complete were employed for inoculating a fresh nutritive substance containing 1 per cent. of a strong solution of humus and 0.25 per cent. of sodium silicate.

Cultivations of nitrifying organisms prepared in this manner proved to be much less sensitive than those obtained by Winogradsky in absence of organic matter. Four stable varieties of nitric and three varieties of nitrous bacteria were isolated. The strongest form of the nitric bacterium resisted the action of steam at 100° for 2 minutes; and one form of nitrous bacterium lived for 1 minute in steam at 100°. Nitric and nitrous bacteria can be cultivated together and do not interfere with each other, and an inoculating material was prepared by drying previously sterilised calcareous soil to which both forms had been added.

Pot experiments are described in which grasses and cereals were grown in sterilised sand to which sterilised humus, ammonium sulphate, and minerals were added, with and without the addition of the inoculating material. With inoculation, the growth was stronger and more luxuriant.

Evidence was obtained that, in presence of an abundance of nitrifying organisms, denitrification is hindered and there is no loss of free nitrogen. When, however, denitrifying organisms predominate, the nitrifying bacteria are injured, especially if aëration is limited.

N. H. J. M.

Germination of the Carob Bean (*Ceratonia Siliqua*): Production of Mannose by a Soluble Ferment. By ÉMILE BOURQUELOT and HENRI HÉRISSEY (*Compt. rend.*, 1899, 129, 614—616).—In the germination of the carob bean, a soluble ferment is produced which acts on the albumin in the seed and produces from it mannose and galactose. Since saliva does not act on this albumin, it follows that the ferment in question is distinct from diastase. This is the first instance of the production of mannose by a soluble ferment (compare *Abstr.*, 1899, i, 839, 968).

C. H. B.

Action of Anæsthetic Vapours on the Vitality of Dry and Moist Seeds. By HENRI COUPIN (*Compt. rend.*, 1899, 129, 561—562).—The germinating power of the seeds of wheat and clover is not in the least affected by exposure, in the dry state, to the saturated vapour of ether or chloroform for 680 hours. These liquids may therefore be safely used for the destruction of insects in grain, and are to be preferred to carbon disulphide, which has an injurious action on some seeds, such as wheat. Experiments with white lupin, purple clover, hairy spring vetch, buckwheat, wheat, barley, maize, and hemp show that moist seeds are much more susceptible to the action of anæsthetics. In an atmosphere containing 1 c.c. of ether per 10 litres, germination takes place as usual; with a larger quantity of ether, growth is more or less retarded, purple clover being the most resistant of the seeds examined, and with 3.7 c.c. of ether per 10 litres all the seeds are killed, and will not germinate even when removed from the action of the ether and washed well with water.

N. L.

Absorption of Water and Dissolved Substances by the Stems of Plants. By ÉMILE BRÉAL (*Ann. Agron.*, 1899, 25, 449—458).—The absorption of different substances by plants was effected by inserting in the stems glass tubes drawn out to a suitable size, containing the solutions.

Whilst nitrates can accumulate in plants, it was found that ammonium salts, although absorbed, are soon converted into other substances. Nitrates accumulated abundantly in the stems, but could not be detected in the roots. Potassium humate was absorbed by lupins, and was afterwards visible when the stems were cut open. In the case of maize, it was observed that absorption of potassium humate resulted in the destruction of the nitrates present. Potassium humate, in conjunction with ammonium phosphate, diminished the amount of nitrate in amaranth without causing its entire disappearance; in the case of lupins, all the pre-existing nitrate disappeared.

N. H. J. M.

Food-stuffs of the Leaves of the Plane-tree and their Migration during the Growth and Decay of the Leaves. By G. M. TUCKER and BERNHARD TOLLENS (*Ber.*, 1899, 32, 2575—2583).—The leaves examined were picked at intervals during the summer; 500

being taken on each occasion; to obtain comparable results, only the two oldest leaves on any one twig were selected. After weighing and measuring the surface of an average sample, the leaves were dried, burnt, and the ash analysed, the constituents determined being SiO_2 , $\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$, CaO , MgO , P_2O_5 , SO_3 , K_2O , Na_2O , Cl , and N .

The results show that the weight and also the amount of ash of the leaves increased until the leaves died, and then slightly decreased. The amounts of silica and lime show a similar behaviour, but the chlorine and sulphuric acid show a continuous increase, leaves plucked in November containing three times as much sulphuric acid as those plucked in June. Those constituents regarded as the more important food-stuffs show a quite different behaviour; the phosphoric acid and the potash increase very slightly until the leaves die, after which they diminish to less than half their original amounts. The amount of nitrogen steadily falls, having at the end a value less than one-fourth of the initial value.

Young leaves gathered in November show the presence of large quantities of potash, phosphoric acid, and nitrogen, the amounts of which are sufficient to account for the loss in these constituents suffered by the older leaves after death; any backward motion of these food-stuffs from the leaves to the stem or wood of the twigs the authors regard as of small amount.

Comparative experiments with leaves protected from rain and others non-protected show that rain has little, if any, washing-out action on the food stuffs of the leaves.

T. H. P.

The Replacement of Potassium Salts by Rubidium Salts in Lower Fungi. By OSCAR LOEW (*Bied Centr.*, 1899, 28, 646—647; from *Bot. Centr.*, 1898, 74, 202—205).—Whilst the author has shown that rubidium can take the place of potassium in putrefaction bacteria, yeast, and *Penicillium*, the results of Günther's experiments indicate that such substitution can take place to some extent in *Botrytis cinerea*, but not in *Rhizopus nigricans*. The experiments now described confirm Günther's observation that differences exist in the case of various fungi as regards the power of utilising rubidium.

Bacillus coli develops equally well in the presence of rubidium and of potassium; *B. pyocyaneus* grows twice as quickly in the presence of potassium as with rubidium. *Cladothrix* failed to develop in the presence of rubidium, whilst a moderate growth was obtained with potassium (the organic food was 1 per cent. dextrose and 0.5 per cent. sodium acetate).

N. H. J. M.

Yellow Colouring Matters accompanying Chlorophyll and their Spectroscopic Relations. By C. A. SCHUNCK (*Proc. Roy. Soc.*, 1899, 65, 177—186. Compare Abstr., 1899, ii, 540).—Alcoholic extracts of healthy green leaves contain two yellow colouring matters: (1) chrysophyll which separates in lustrous, red crystals, usually in minute quantities, and (2) an amorphous substance to which the author would restrict the name xanthophyll. This is obtained by spontaneous evaporation of the solution, after removing the chlorophyll by means of animal charcoal, and is impregnated with much

fatty matter. Another yellow colouring matter sometimes occurs with the xanthophyll; this gives no absorption bands, but only an obscuration in the violet and ultra-violet portion of the spectrum. Other yellow colouring matters may exist, but xanthophyll seems to predominate, and is also the principal yellow colouring matter of autumn leaves.

The absorption spectrum of chrysophyll consists of three bands, that of xanthophyll of four bands, in the violet and ultra-violet portions. The author concludes that the spectrum of crude chlorophyll (four bands in the less refrangible region and three in the violet) are due to chlorophyll alone, and not, as usually supposed, in part to the accompanying yellow colouring matters. Phyllocyanin and phylloxanthin have bands in positions identical with the three chlorophyll bands in the violet part of the spectrum. N. H. J. M.

Wheat. By GEORGE B. FRANKFORDER and E. P. HARDING (*J. Amer. Chem. Soc.*, 1899, 21, 758—769).—The germ of wheat was found to contain on the average 11.6 per cent. of oil. The sp. gr. of the oil is 0.9292 at 15° and 0.9374 at 0°. At 0°, the oil is a cloudy semi-solid, at 15° it is milky, and at 100° it becomes reddish-brown. When dried at the ordinary temperature, it increases slightly in weight during the first 45 days, and loses rather more during the next 30 days. The index of refraction of the oil when purified is 1.48325, 1.47936, and 1.47447 at 20°, 30°, and 40° respectively. As regards solubility, 1 gram of the oil dissolves in 1 c.c. of ether, 1 c.c. of chloroform, 30 c.c. of absolute alcohol, or 250 c.c. of 90 per cent. alcohol. The saponification value, according to Köttstorfer's method, is 188.83 mg. of KOH to 1 gram of oil. Iodine number (Hübl) 115.64. Acid value, 40.7. Five determinations of glycerol gave an average percentage of 7.35. The oil contains 2.0 per cent. of lecithin and 2.47 (mean of 5 analyses) of paracholesterol. The elaidin method gave 1.8 and 2.2 per cent. of paracholesterol. N. H. J. M.

Constituents of Chicory. By JULES WOLFF (*Chem. Centr.*, 1899, ii, 211—212; from *Ann. chim. anal. appl.*, 4, 157—162, 187—193).—The root of *Cichorium Intybus* contains inulin, $6C_6H_{10}O_5 + H_2O$, but no starch. The inulin obtained from the aqueous extract of the root by precipitating with 90 per cent. alcohol has a specific rotatory power $[\alpha]_D - 36.57^\circ$ (Lescœur and Morelle) and does not reduce Fehling's solution. It is completely inverted by boiling for 20 minutes with 5 c.c. of hydrochloric acid, and the levulose formed may be estimated by reduction or polarimetrically. An optically inactive sugar, *levulin* or *synanthrose*, which does not reduce Fehling's solution, is also present, and is decomposed by hydrochloric acid into dextrose and levulose. Chicory only contains a very small quantity of a sugar which reduces Fehling's solution directly, and this is probably levulose derived from the inulin. The sugars are practically unchanged by drying the root, but by roasting, the quantity of reducing sugars which consist mainly of levulose with some dextrose is increased, a large portion of the inulin is changed, and caramel and dextrin are formed.

The inulin contained in chicory may possibly be of use as a food in

cases of diabetes. The fresh root contains about 13—15 per cent. and commercial chicory from about 11—16 per cent. of inulin. Analyses of the fresh root, the dried material, and samples of commercial chicory are quoted.

E. W. W.

Constituents of Flores Kosso. By IWAN L. KONDAKOFF (*Arch. Pharm.*, 1899, 237, 481—493).—An historical account of previous investigations, serving as an introduction to the following abstract (compare especially, Flückiger and Buri, *Abstr.*, 1875, 468; Levin, *Diss.*, St. Petersburg, 1892; Leichsenring, *Abstr.*, 1894, i, 424; Dacomo and Malagnini, *Abstr.*, 1899, i, 158).

C. F. B.

Kossin or Taeniin of Pavesi and Vée. By IWAN L. KONDAKOFF and N. SCHATZ (*Arch. Pharm.*, 1899, 237, 493—507).—*Flores Kosso*, the female flowers of *Hagenia abyssinica*, are used as a vermifuge; the sample examined contained moisture 10.5 and ash 10.3 per cent. The flowers were treated with lime, 90 per cent. alcohol, and water, after the method of Pavesi (*Journ. Pharm. d'Amers*, 1858, 472) and Vée (*Neuss Rep. Pharm.*, 8, 325); the alcohol was distilled off from the extract, and the residue decomposed with acetic acid, when kossin separated. When a solution of kossin in cold acetic acid or in alcohol is allowed to remain, crystals of kossin separate. If a solution of kossin in caustic alkalis is acidified with phosphoric acid, or a solution in baryta water decomposed with carbon dioxide, an amorphous variety of kossin, melting at 142°, separates; probably kossin contains a good deal of this.

The ethereal extract of another sample of the flowers contained (a) an amorphous substance mixed with (b) another substance, which was insoluble in cold alcohol, and formed crystals melting at 63°, (c) an amorphous substance, characterised by acid and reducing properties, and melting at 155—157°; (d) a wax-like substance, melting at 55°; (e) a resinous substance, and (f) kosotoxin. The latter amounted to 6 per cent. of the dry extract (which itself formed 4.7 per cent. of the drug). As regards kosotoxin, Leichsenring's results were not entirely confirmed; the melting point is 76°; the molecular formula, as determined by analysis and cryoscopically, is $C_{25}H_{32}O_9$, and the acid formed, in addition to kossin, when kosotoxin is boiled with 5 per cent. aqueous barium hydroxide, is not wholly a butyric acid, but contains another acid (valeric?) admixed.

The residue left after extraction of the flowers with ether yielded to alcohol an amorphous tannin, the amorphous substance (a), kosotoxin, and other substances which were not separated.

C. F. B.

Detection of Sulphur Dioxide in the Atmosphere of the Tharandt Forest. By HANS WISLIGENUS (*Bied. Centr.*, 1899, 29, 643—644; from *Tharandt forst. Jahrb.*, 1898, 173—184).—Experiments made by the Ost process from May to October in different parts of the forest, at a distance of 10 kilometres from any source of smoke, showed the presence of sulphur dioxide inside the forest, although in less quantity than at the edges. The results of previous experiments indicate, however, that in consequence of the limited amount of light in the forest the sulphurous acid is comparatively harmless.

N. H. J. M.

Maize as Food in Servia. By ALEXANDER ZEGA and R. MAJSTOROVIĆ (*Chem. Zeit.*, 1899, 23, 544—545).—Maize is the most important food in Servia, and in some districts nothing else is used. Besides boiled and roasted maize, different kinds of bread (including "famine bread," an inferior kind in which carrots, nettles, &c., are employed as well as maize), cakes, and other kinds of food, and a beverage, prepared from maize meal and wheat bran, are described. Maize meal (1) yellow, and (2) white, has the following composition :

	Water.	Nitrog. subst.	Fat.	Carbo- hydrates.	Sugar.	Crude fibre.	Ash.	P ₂ O ₅ .
1.	12.69	10.11	4.23	67.44	2.70	1.43	1.40	0.74
2.	13.36	9.56	4.84	66.36	2.68	1.72	1.48	0.68

The composition of the various foods is given.

N. H. J. M.

Determination of the Action of some new Foods on the Secretion of Milk, with Special Reference to the Amount of Fat in the Rations formed with these Foods. By EBERHARD RAMM and W. MINTROP (*Bied. Centr.*, 1899, 28, 614—616; from *Milchzeit.*, 1898, No. 33).—The following conclusions are drawn from the results of the feeding experiments. A high percentage of fat in food does not result in higher percentage of fat in milk, but the different concentrated foods, in rations differing very little in composition, produced considerable variations in the percentage of fat in the milk (2.327—3.437).

As regards the various foods, it was found that cocoa-molasses (cocoa-husk meal mixed with molasses) was consumed in large amounts and, in conjunction with oil-cake rich in proteids, increased the yield of butter-fat above the average. Maize bran had no injurious effect on the health of the cows, even when consumed in large quantities. Blood molasses (blood, molasses, and offal of cereals) in quantities of 6—8 kilos. was not injurious, was in every respect favourable to milk secretion, and is a very valuable food for cows.

N. H. J. M.

Value of various Concentrated Foods. By WALDEMAR VON KNIERIM (*Bied. Centr.*, 1899, 28, 616—618; from *Landw. Jahrb.*, 1898, Heft. 3 and 4).—The constituents of cocoa-nut cake show, according to results obtained with rabbits, the following percentage digestibility: crude protein, 95.7; crude fat, 99.1; crude fibre, 89.1; non-nitrogenous substance, 95.2. With a ram, the results were very similar (except in the case of crude fibre) to those obtained by Kühn with bullocks. The cake is one of the best concentrated foods. Hemp cake causes indigestion with rabbits as well as with sheep and horses; it can, however, be given to cows in conjunction with considerable amounts of roots, potatoes, malt-germs, or brewers' grains, and is of importance in the feeding of young cattle. Sunflower cake gave lower results with rabbits than those given by Wolff, which were obtained with sheep. Rape cake in small quantities favours the digestion of non-nitrogenous constituents; in the case of cows, it must be employed with care to avoid indigestion, especially when the cake develops mustard oil. Palm cake resembles cocoa-nut cake and is chiefly useful in promoting milk production.

N. H. J. M.

In Feeding with Sesamé Cake, do Substances which give the Baudouin Reaction appear in the Butter? By H. WEIGMANN (*Bied. Centr.*, 1899, 28, 629—630; from *Milchzeit.*, 1898, 529).—Experiments with cows in which sesamé cake was given in increasing quantity (up to 3 kilos. per day) showed that the butter was quite free from sesamé oil.

In examining butter for sesamé oil, it is important to employ only 0·1 c.c. of 1 per cent. furfuraldehyde solution; with 1 per cent. sesamé oil or 10 per cent. margarine, the coloration appears at once, whilst any other coloration can only appear in the course of about half an hour. The results obtained by Scheibe (*Milchzeit.*, 1897, 745) and Siegfeld (*Bied. Centr.*, 1899, 28, 415), which are opposed to those just described, are attributed to the employment of unsuitable amounts of furfuraldehyde, and to the correct conditions as to time and temperature not having been observed. N. H. J. M.

Alkali Soil in Montana. By FRANK W. TRAPHAGEN and W. M. COBLEIGH (*J. Amer. Chem. Soc.*, 1899, 21, 753—757).—The bare patches of soil incrustated with white, red, or yellow salt which occur in Montana, and are known as "alkali" soils, are of two kinds, the "white," consisting mainly of sodium sulphate, and the "black," of sodium carbonate. The appearance of the latter is due to the solvent action of the carbonate on humus which, on evaporation, is left as a shiny black coating on the surface. As little as 0·1 per cent. of sodium carbonate at the surface is deleterious, whilst crops will thrive in the presence of as much as 0·6 per cent. of "white alkali." Larger quantities of white alkali are injurious rather by interference with the process of osmosis than through any chemical action.

Analyses of different soils and crusts are given, showing that the amounts of soluble salts differ widely; there is, however, a very constant relation of the amounts of different salts in the extracts. In virgin soils, the alkali occurs at considerable depths, and is mostly concentrated in a particular zone. Under the influence of irrigation, the salts rise to the surface. The best remedy would seem to be under-drainage, but, in the case of land of insufficient value, much can be done by careful surface flooding and suitable cropping.

N. H. J. M.

Distribution and Biological Importance of Furfuroids in Soil. By JULIUS STOKLASA (*Bied. Centr.*, 1899, 28, 588—589; from *Zeit. landw. Versuchswesen Oesterr.*, 1898, 1, 251—266. Compare Abstr., 1898, ii, 132).—The furfuroids in soil are produced by algæ and bacteria. The dry substance of *Pleurococcus vulgaris*, which grows on rocks, contains 3·43, that of *Nostoc*, 5·06 per cent. of pentosans. Cultures of *Bacillus mesentericus*, which is very common in soils, contained 2·31 per cent. of pentosans in the dry substance. *Parmelia*, *Lecanora*, *Hypnum Schreberi* and *H. dicranum*, and *Sphagnum cymbifolium* contain respectively 3·46, 3·43, 6·19, 10·78, and 15·44 per cent. of pentosans. Other plants of importance in peat production were found to contain the following amounts of pentosans: *Pteris aquilina*, 18·8; *Aspidium*, 19·1; *Equisetum arvense*, 33·5 and 21·1; *Lycopodium*, 24·6; *Carex acuta*, 19·6 in above-ground growth

and 26.5 in roots; *Calluna vulgaris*, 17.3 and 23.2 per cent. in above-ground growth and roots respectively.

Peat was found to contain 17.4 per cent. of pentosans in the first 10 cm., 10.38 per cent. at a depth of 50 cm., 5.34 per cent. at 100 cm., and 1.60 per cent. at a depth of 2 metres. The surface soil of forest land yielded 3.27, the soil at a depth of 50 cm. 0.83 per cent. of furfuraldehyde.

N. H. J. M.

Observations on the Growth of Maize continuously for Nine Years. By EDWARD H. JENKINS (*Ann. Rep. Conn. Agric. Exper. Stat.* for 1896, No. 20, 335—341).—The four plots received: (1) cow manure, (2) hog manure, (3) chemical manures, and (4) no manure. The average relative yield of dry produce from 1890—1896 was as follows: plot 1, 100; plot 2, 100.4; plot 3, 81.8; and plot 4, 51.0. Taking the produce of each plot as 100 in 1890, the following amounts were obtained in 1896. (1), 116; (2), 101; (3), 79; (4), 31.

The average composition (6 years) of the kernels and stalks was practically the same in the case of plots 1 and 2. In plot 3 (1,500 lbs. of chemical manure), the kernels contain rather less ash and fat, and 0.5 per cent. less proteids than those of plots 1 and 2, but more nitrogen-free extract. The stalks show similar differences. The kernels of the unmanured plot contain 2 per cent. less proteids, rather less ash and fat, but more fibre and nitrogen-free extract than those of plots 1 and 2.

The calculated gain or loss of manure constituents in the soil after 9 years cropping with maize was as follows in lbs. per acre:

Plot 1.			Plot 2.			Plot 3.			Plot 4.		
N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
+1283	+898	+156	+2174	+3987	-7	+611	+1111	+171	-388	+46	-78

N. H. J. M.

Manurial Experiments with Barley. By JOSEPH HANAMANN (*Bisd. Centr.*, 1899, 28, 638; from *Zeit. landw. Versuchswesen Oesterr.*, 1898, 1, 277—285).—The experiments were conducted in zinc vessels containing 12.5 kilograms of sandy soil, loamy sand, loam, and clay soil respectively (five pots in each case). One pot of each soil was without manure, whilst pots 2—4 received sodium nitrate and potassium chloride. The third pots had in addition superphosphate, the fourth pots basic slag (containing the same amount of phosphate as was given to No. 3), the fifth pots basic slag in double quantity.

The results indicate that spring manuring with basic slag is only advisable in the case of sandy soil, loamy sand, and peaty soil, but not in the case of loamy and clay soils, and the amount applied should be twice as great as that of superphosphate.

N. H. J. M.

Manurial Experiments with Lucerne. By MAX MAERCKER (*Bisd. Centr.*, 1899, 28, 635; from *Landw. Jahrb.*, 1898, 27, 155).—It is thought that liberal application of phosphates will not only increase the yield of lucerne, but will be of use in preventing the injurious effects of lucerne on a succeeding cereal crop (liability to be laid, fungus attack, &c.).

N. H. J. M.

Experiments on the Availability of Fertiliser-Nitrogen. By SAMUEL W. JOHNSON, EDWARD H. JENKINS, and W. E. BRITTON (*Ann. Rep. Conn. Agric. Exper. Stat.* for 1896, No. 20, 178—204. Compare *ibid.*, No. 19, and Abstr., 1896, ii, 620).—The nitrogen availability of the different manures for maize grown in coal-ashes and peat, compared with that of sodium nitrate as 100, was found to be as follows (average of three years, 1894—6): collier castor pomace, 77; cotton seed meal, 74; red seal castor pomace, 70; linseed meal, 70; dried blood, 68; dry fish, 69; dissolved leather, 65; horn and hoof, 67; tankage, 61; steamed leather, 13; roasted leather, 9; raw leather, 2.

On comparing the nitrogen availability of some nitrogenous superphosphates, determined by vegetation experiments, with the solubility in chemical agents, the following results were obtained:

	Available for maize.	Soluble in pepsin.	Soluble in permanganate. Acid.	Alkaline.
Blood	47	47	47	47
Tankage	45	39	45	43
Horn and hoof ...	43	28	42	52
Leather	3	8	14	25

The chemical methods would therefore seem to be of value as indicating the probable relative effect of inferior nitrogenous manures. The agricultural value cannot, however, at present be fixed without vegetation experiments.
N. H. J. M.

Manurial Experiment on Meadow Land. By MAX MAERCKER (*Bied. Centr.*, 1899, 28, 637; from *Landw. Jahrb.*, 1898, 27, 151).—The effect of potassium phosphate and of kainite was to increase the percentage of proteids in the hay owing, as a botanical separation of the herbage showed, to increased growth of more nitrogenous plants, especially *Leguminosæ*.
N. H. J. M.

Field Experiments on Peat Land, 1892—1897. By BRUNO TACKE (*Bied. Centr.*, 1899, 28, 589—611; from *Landw. Jahrb.*, 1898, 27, iv, 1—258. Compare Abstr., 1897, ii, 515).—Manure salts containing 38 per cent. of potash as potassium chloride gave very good results with potatoes, and had practically no injurious effect when applied in the spring in amounts of as much as 200 kilos. of potash per hectare. Carnallite and kainite (225 kilos.) applied in the spring considerably diminished both the yield of tubers and the amount of starch; in some cases there is a decrease of starch in the dry matter, in others the lower percentage of starch in the tubers is due to an increase in the amount of water. Application of lime seems to lessen the injurious effect of spring manuring with potash on potatoes.

Application of lime or marl to the soil for all kinds of crops is very beneficial for a time, and is even necessary when artificial manures are employed, but is subsequently injurious owing to the shrinking of the comparatively shallow layer of the surface soil. The injury can be overcome by subsoil liming.

Phosphoric acid in the form of phosphorite should only be applied to peat land which retains a certain degree of acidity.

N. H. J. M.

Manurial Experiments with Phosphorite and Basic Slag. By A. SEMPOŁOWSKI (*Bied. Centr.*, 1899, 28, 637—638; from *Zeit. landw. Versuchswesen Oesterr.*, 1898, 1, 267—276).—Whilst hard crystalline phosphorite has to be converted into superphosphate, the so-called soft, non-crystalline mineral, if finely ground, can be employed, without further treatment, as manure. Experiments in which barley was grown in sandy loam and in peaty soil (contained in bottomless wooden boxes) manured with phosphorite meal and basic slag respectively, in addition to other manures, showed that the phosphorite was decidedly effective, the increased production of barley, over the unmanured plots being not much less than that obtained under the influence of basic slag.

N. H. J. M.

Comparison between Bone- and Mineral-Superphosphate. By ANGELO MENOZZI (*Bied. Centr.*, 1899, 28, 635; from *Agricolt. moderna*, 1897, 50).—Maize grown in large zinc vessels was manured with equal amounts of phosphoric acid in the form of superphosphate from degelatinised bones and Florida phosphate respectively, in addition to other manures. The results indicated only slight superiority of the bone as compared with the mineral superphosphate.

N. H. J. M.

Phosphate Deposits in Japan. By K. TSUNETO (*Chem. Zeit.*, 1899, 23, 800 and 825—827).—In 1894, large deposits of phosphates were discovered in the miocene formation, extending over 720 square kilometres, in the south-west of the island Kiushu. The phosphates occur in nodules and aggregates in the lime-sandstone, in marl veins, and in dark brown veins of sandstone situated between the calcareous fine-grained sandstone. The nodules are generally rich in phosphates in the inner portion, whilst the outer layer is rich in iron; they contain organic remains. The following is the percentage composition of (1) grey nodules, (2) light brown nodules, (3 and 4) aggregates, (5) balls, and (6) breccia:

	Water and organic.	K ₂ O.	Na ₂ O.	CaO.	MgO.	FeO.	Fe ₂ O ₃ .	Al ₂ O ₃ .	Mn ₂ O ₃ .	P ₂ O ₅ .	SO ₃ .	CO ₂ .	Insol.
1.	1.26	—	—	9.62	2.28	8.77	2.98	2.14	0.35	8.35	0.29	8.26	55.65
2.	1.48	—	—	12.71	2.28	8.95	2.99	2.88	0.39	4.76	0.53	7.08	55.25
3.	0.65	—	—	11.73	2.36	7.37	2.46	1.65	0.23	5.85	0.63	7.92	54.22
4.	0.89	—	—	10.56	1.14	7.88	1.64	2.00	—	7.14	0.51	6.81	57.43
5.	2.21	2.25	0.42	30.28	1.30	—	3.76	3.72	—	20.29	1.23	1.82	28.38
6.	2.15	1.04	0.42	16.76	1.20	—	3.89	1.98	—	9.47	trace	2.28	47.15

In (5), a trace of chlorine and 2.09 per cent. of fluorine were found, and in (6) Cl=0.06 and F=2.13 per cent.

Although the percentage of phosphoric acid is generally low, the deposits are of importance in Japan where manures with very low percentages of phosphates are utilised. The best method for utilising the minerals containing 5—10 per cent. of phosphates seems to be extraction of the ground substance with 12.45 per cent. sulphuric acid (avoiding too great a rise of temperature) in amounts sufficient to decompose the phosphates and carbonates present.

N. H. J. M.

The Reversion of Soluble Phosphoric Acid in Superphosphates. By LUDWIG SCHUCHT (*Chem. Centr.*, 1899, i, 1165—1166; from *Chem. Ind.*, 22, 152—155).—Reversion does not take place unless the superphosphate is closely packed and consequently submitted to pressure. Ferric and aluminium compounds are harmful as their phosphates act on the undecomposed calcium triphosphate and so yield insoluble phosphates. Silicates are also a source of loss in phosphoric acid; their amount may be lessened by adding a regulated quantity of fluor-spar during the preparation of the superphosphate.

L. DE K.

Analytical Chemistry.

Standardising Acids. By ANTON SEYDA (*Chem. Centr.*, 1899, i, 1164; from *Zeit. öffentl. Chem.*, 5, 141—151).—Sodium carbonate, used for standardising acids, is likely to retain excess of carbon dioxide, or if overheated it may contain sodium hydroxide. A suitable article is, however, obtained by heating sodium hydrogen carbonate for an hour at 220° in an air-bath.

The results then perfectly agree with those obtained by standardising the acid with the aid of potassium hydrogen tartrate or ammonium chloride.

L. DE K.

Estimation of Sulphur in Bitumens. By STEPHEN F. PECKHAM and H. E. PECKHAM (*J. Amer. Chem. Soc.*, 1899, 21, 772—776).—In reply to Hodgson, the authors state that in order to get accurate estimations of sulphuric acid, any iron or aluminium oxides should be first removed.

The following method has been finally adopted for the estimation of sulphur in bitumen. A quantity of the substance representing about 0.5 gram of real bitumen is mixed with 15 grams of pure dry sodium carbonate and 15 grams of potassium nitrate and the mixture then fused by degrees in a platinum crucible. The product is dissolved in dilute hydrochloric acid, evaporated to dryness, and gently ignited to render any silica insoluble; the residue is then treated with dilute hydrochloric acid and the solution precipitated, while boiling, with a slight excess of ammonia to remove iron and aluminium. If desired, any calcium may be precipitated as oxalate. The filtrate is now acidified with hydrochloric acid and the boiling liquid precipitated with barium chloride solution added carefully from a pipette.

L. DE K.

Estimation of Hyposulphurous Acid. By N. FRADISS (*Chem. Centr.*, 1899, i, 1223; from *Bull. Assoc. Chimistes*, 16, 453).—The solution is neutralised and added from a burette to an ammoniacal standard solution of copper sulphate until this is quite decolorised. The presence of sulphites does not interfere. 1 mol. of hyposulphurous acid reduces 2 mols. of copper oxide to the cuprous state.

L. DE K.

Volumetric Estimation of Sulphuric Acid. By FRANZ LITTELSCHIED and KARL FEIST (*Arch. Pharm.*, 1899, 237, 521—525).—The authors have developed independently the method described by Grützner (this vol., ii, 530). The solution of the sulphate is acidified with hydrochloric acid, heated to boiling, treated with a measured excess of $N/4$ barium chloride solution, stirred well, and allowed to remain in a warm place for half-an-hour; the liquid is then made strongly alkaline with ammonia, excess of ammonium carbonate solution added, and the whole stirred and allowed to remain at 50—60° for ten minutes. The precipitate is then collected on a small filter, washed three or four times with hot water, and transferred to a conical flask, when the barium carbonate is titrated with $N/10$ hydrochloric acid. It may be titrated directly when methyl-orange is employed as an indicator; if phenolphthalein be used, excess of $N/10$ acid must be added, the carbon dioxide driven off by boiling, and the excess of acid titrated with $N/10$ caustic potash. On multiplying by 0.4 the number of c.c. of $N/10$ acid neutralised and subtracting the product from the number of c.c. of $N/4$ barium solution taken, the remainder multiplied by 0.01 gives the weight of SO_3 present, or multiplied by 0.004 the weight of S.

The solution of the sulphate must not contain any acid of which the barium salt is insoluble, such as phosphoric and oxalic acids; neither must it contain substances which are precipitated by ammonium carbonate, or, like tartaric and citric acids, hinder the precipitation of the barium. Alkaloids, if insoluble in ammoniacal ammonium carbonate solution, must be removed by extraction with a suitable solvent. The sulphates of potassium, sodium, ammonium, rubidium, cesium, copper, zinc, cadmium, nickel, and cobalt, may be estimated directly; so also that of lithium, provided the solution be dilute enough to retain the lithium carbonate in solution (solubility: 1 in 75 parts of water at 50°). Iron sulphate, and the solution obtained by oxidising copper pyrites with nitric acid and potassium chlorate, may also be estimated, if the iron is first removed as hydroxide. With magnesium sulphate, good results have not yet been obtained.

C. F. B.

Titration of Persulphates. By MAX LE BLANC and M. ECKARDT (*Zeit. Elektrochem.*, 1899, 5, 355—357).—The reaction between a persulphate and a ferrous salt in solution is comparatively slow at the ordinary temperature; erroneous results may therefore be obtained in the analysis of persulphates by treating the solution with ferrous sulphate and titrating the excess with permanganate. These errors are very easily avoided by warming the acidified mixture of persulphate and ferrous ammonium sulphate to 60—80° before titrating with permanganate.

T. E.

Estimation of Tellurous Acid in Presence of Haloid Salts. By FRANK A. GOOCH and C. A. PETERS (*Amer. J. Sci.*, 1899, 8, 122—126).—Tellurous acid is generally estimated by adding to its alkaline solution a slight excess of standard potassium permanganate. A definite volume of standardised ammonium oxalate is added, and then a sufficiency of dilute sulphuric acid (1 : 1) so as to have about 5 c.c. of the acid in excess. After heating at 60—80°, the excess of oxalic acid is estimated by standard permanganate.

The authors find that the presence of chlorides does not interfere if before the final titration about 1 gram of crystallised manganous chloride is added. Bromides are also harmless if the same precaution is taken and the temperature not allowed to rise above 25°.

In the case of iodides, the process breaks down, so another method was successfully tried. The alkaline solution is mixed with a known volume of potassium permanganate, previously standardised with a standard solution of arsenious acid, and, after a while, a slight excess of dilute sulphuric acid is added, with, if necessary, some more potassium iodide; after adding a slight excess of potassium hydrogen carbonate, the liberated iodine is titrated with the standard solution of arsenious acid, the end reaction being the disappearance of the yellow colour; starch need not be used as an indicator.

Supposing the two solutions balance each other—the difference in the two titrations equals the number of c.c. of permanganate consumed by the tellurous acid.

L. DE K.

Detection of Nitric Acid in Cadaveric Matter. By DIOSCORIDE VITALI (*Zeit. anal. Chem.*, 1899, 38, 539—541; from *Oesterr. Chemikerzeit.*, 1, 330).—For the detection of free nitric acid in animal matter in which nitrates may already be present, either as normal constituents or by introduction in food, it is useless to distil with water, for the mineral acids combine with albumin, forming acid-albumins, which in many cases are not decomposed at 190°. The substance is therefore digested on the water-bath with freshly precipitated barium carbonate, the solution evaporated to dryness, and the residue boiled repeatedly with absolute alcohol for the removal of calcium and magnesium nitrates. The alcoholic solution will also contain the soluble acid-albumin. It is evaporated to dryness, the residue dissolved in water, and exactly neutralised with barium hydroxide solution, which decomposes the acid-albumin. The solution is again evaporated and the nitrates separated by absolute alcohol. The residual barium nitrate is then dissolved in water, decolorised with lead acetate, freed from lead by hydrogen sulphide, and the concentrated solution finally crystallised in the desiccator. The residue from the first treatment with alcohol contains the barium nitrate derived from the presence of free acid as well as insoluble acid-albumin, and possibly some calcium nitrate. It is treated with a dilute solution of sodium carbonate until an alkaline reaction is just obtained. The acid-albumin and the barium nitrate are by this means converted into sodium nitrate, the calcium nitrate remaining undecomposed. The filtered solution is evaporated to dryness and the residue boiled with absolute alcohol. The sodium nitrate dissolves, but it is stated that the calcium nitrate remains undissolved. The sodium nitrate is purified and identified in the same way as the barium nitrate above. [W. Fresenius expresses grave doubts as to the correctness of some of the above reactions, and points out that the author contradicts himself, as well as established fact, in stating that calcium nitrate is undissolved by boiling alcohol.]

Another method consists in treating the animal matter with freshly precipitated strychnine, when strychnine nitrate is formed. This

can be purified by solution in boiling alcohol, the colour removed with lead acetate, and the nitrate finally obtained as crystals.

A very sensitive reaction for nitric acid is obtained by adding salicin and 8—10 drops of concentrated sulphuric acid to the residue of an evaporated solution. A blood-red coloration is produced, which becomes violet on dilution.

M. J. S.

Estimation of Arsenic in Paris Green. By THORN SMITH (*J. Amer. Chem. Soc.*, 1899, 21, 769—772).—Two grams of the sample are boiled with 100 c.c. of water and 2 grams of sodium hydroxide; when cold, the liquid is made up to 250 c.c., well shaken, and filtered through a dry filter. 50 c.c. are then concentrated to 25 c.c., and after cooling to 80°, 25 c.c. of hydrochloric acid and 3 grams of potassium iodide are added. After remaining for 10 minutes, any arsenic acid will be completely reduced to the arsenious state and the liberated iodine is removed by diluting with water and carefully decolorising with solution of sodium thiosulphate. After first neutralising with, and then adding an excess of sodium hydrogen carbonate, the arsenious acid is titrated in the usual manner with $N/10$ solution of iodine.

L. DE K.

Estimation of Boric Acid in Tourmaline. By GEORGE W. SARGENT (*J. Amer. Chem. Soc.*, 1899, 21, 858—887).—The paper contains a summary of all the chief methods proposed for the estimation of boric acid, and the author's opinion as to their respective merits.

When dealing with tourmaline and similar minerals containing aluminium, the chief difficulty arises from the incomplete separation of boric acid and alumina, the only way of effecting complete separation is by the method proposed by Gooch, namely, volatilisation of the acid by means of methyl alcohol, coupled with the titration of the volatilised acid by Thomson's glycerol method.

L. DE K.

Iodometric Method for the Estimation of Boric Acid. By LOUIS C. JONES (*Amer. J. Sci.*, 1899, 8, 127—132. Compare *Abstr.*, 1899, ii, 332).—Under certain definite conditions, a mixture of boric acid and mannitol possesses an acidic power sufficiently strong to liberate iodine from a mixture of potassium iodide and iodate. The iodine is readily estimated by means of sodium thiosulphate, and represents the amount of boric acid.

To obtain correct results, the following mode of procedure should be used: the borate is dissolved in the smallest possible quantity of hydrochloric acid and then diluted with water so that 50 c.c. of liquid shall contain about 0.1 gram of boric acid. The greater part of the free acid is then neutralised with sodium hydroxide and 5 c.c. of a 40 per cent. solution of potassium iodide and 10 c.c. of a 5 per cent. solution of potassium iodate are added and the liberated iodine at once removed by a few drops of a strong solution of sodium thiosulphate. After restoring a very faint yellow colour by means of standard iodine, 15 grams of mannitol are added, and when dissolved, a standard solution of sodium thiosulphate is added until the colour is bleached, when an extra 10 c.c. are added. A little more mannitol is added and after standing in a cool place for an hour, the excess of thiosulphate is carefully titrated by means of standard iodine solution.

L. DE K.

Stutzer and Hartleb's Process for the Estimation of Combined Carbon Dioxide (Calcium Carbonate) in Soils. By H. SCHÜTTE (*Zeit. angew. Chem.*, 1899, 854—858).—The author criticises this process (*Abstr.*, 1899, ii, 521) and states that, although good enough for marls, it is not sufficiently accurate for the estimation of small quantities of calcium carbonate in soils.

The chief objection to the process is that ammonium chloride also acts on calcium in combination with silicic acid, and so causes the results to be in excess of the truth. Ferrous carbonate is also stated to interfere with the accuracy of the method, and cannot always be completely decomposed by boiling.

L. DE K.

Gas Washing Apparatus: Rapid and Accurate Process for the Estimation of Carbon Dioxide. By ROBERT SCHALLER (*Zeit. angew. Chem.*, 1899, 878—880).—The apparatus is essentially a U-tube 17 cm. long, one side of which is very narrow and serves to admit the current of the gas. The other side is filled with glass beads 2 mm. in diameter, which are moistened with the absorbing liquid.

In the new apparatus for estimating carbon dioxide, the substance is decomposed in a kind of test-tube with hydrochloric acid, and the carbon dioxide is swept out by means of a current of air which has been freed from this gas by passing through two of the U-tubes containing a solution of potash. The gas then passes through a similar tube containing sulphuric acid before it reaches the absorber. The latter consists of one or two similar weighed U-tubes containing 10 c.c. of 50 per cent. solution of potassium hydroxide. These tubes are, in addition, fitted with a small test-tube 8 cm. long containing 1 c.c. of strong sulphuric acid, and provided with a doubly perforated rubber cork. Through one of the holes passes a tube with a bulb in its centre and drawn to a narrow point at the bottom, the object being to prevent any escape of moisture from the apparatus. The other hole is fitted with a small bent tube to allow the air to escape.

L. DE K.

Estimation of Calcium Carbonate in Marls. By HERMANN NOLL (*Zeit. angew. Chem.*, 1899, 859—860).—The process recommended by Tacke is found to answer for the estimation of calcium carbonate in marls, as it is not affected by the presence of small quantities of ferrous and aluminium compounds or of calcium silicate. The details of this process are briefly as follows: 0.2 gram of the powdered sample is mixed with 200 c.c. of warm water, 25 or 50 c.c. of *N*/5 normal sulphuric acid are added, and the carbon dioxide expelled by boiling. The excess of acid is then titrated with standard baryta, using phenolphthalein as indicator.

L. DE K.

New Volumetric Method for the Estimation of Magnesium. By RICHARD K. MEADE (*J. Amer. Chem. Soc.*, 1899, 21, 746—752).—The process is an indirect one. The ammoniacal solution free from calcium is precipitated with a solution of sodium arsenate, and the excess of the reagent removed by washing with dilute aqueous ammonia (1 : 3). The arsenical precipitate is then dissolved in 75—100 c.c. of dilute

hydrochloric acid (1:1), potassium iodide added, and the liberated iodine titrated with standard solution of sodium thiosulphate.

L. DE K.

Double Ammonium Phosphates of Beryllium, Zinc, and Cadmium in Analysis. By MARTHA AUSTIN (*Amer. J. Sci.*, 1899, 8, 206—216).—When salts of these three metals are precipitated by boiling with excess of sodium ammonium hydrogen phosphate, double ammonium phosphates are obtained, which, on ignition, yield the corresponding pyrophosphates.

It has, however, been found impossible to accurately estimate beryllium in this manner. Zinc may be estimated if care be taken to precipitate the metal from a neutral solution containing 10 per cent. of ammonium chloride. The process is also well adapted for cadmium; the solution should contain 10 per cent. of ammonium chloride, be practically neutral, and be allowed to remain several hours before filtering.

L. DE K.

Analysis of Zinc for Cadmium and Lead. By P. A. MACKAY (*J. Amer. Chem. Soc.*, 1899, 21, 940—941).—The metal is treated with dilute hydrochloric acid in sufficient quantity to dissolve the bulk of the zinc; the undissolved portion then contains all the lead and cadmium present.

After dissolving the residue in nitric acid, the lead is recovered in the usual way as sulphate, and in the filtrate the cadmium is precipitated by hydrogen sulphide; the cadmium sulphide is then collected, washed, and redissolved in boiling hydrochloric acid and titrated with potassium ferrocyanide. It has been noticed, however, that small quantities of cadmium can only be accurately estimated in the presence of zinc, and also that 1 gram-mol. of cadmium requires 3·676 gram-mols. of potassium ferrocyanide, instead of 3·767, as required by theory. A solution containing 10 grams of zinc per litre is prepared, and 50 c.c. of this titrated with a solution containing 36·76 grams of potassium ferrocyanide per litre, using uranium acetate as indicator. Another 50 c.c. is then added to the liquid containing the cadmium, and the titration is repeated; each c.c. excess of ferrocyanide solution used in this titration represents 0·01 gram of cadmium.

L. DE K.

Electrolytic Estimation of Zinc in the Presence of Manganese. By EMIL J. RIEDERER (*J. Amer. Chem. Soc.*, 1899, 21, 789—792).—Zinc may be conveniently separated from manganese by electrolysis. The solution, which should not contain chlorides or nitrates, but only sulphates, is mixed with 5 grams of ammonium lactate, 0·75 gram of lactic acid, 2 grams of ammonium sulphate, and then made up to 230 c.c.; the amount of zinc should not exceed 0·17 gram. The cathode, which should be 1½ cm. distant from the anode, should consist of a platinum dish on which silver has been deposited, and during the action of the current it is advisable to use a mechanical stirrer so as to obtain an even and uniform deposit of zinc; the current may vary from 0·20—0·26 ampères and the temperature from 15—26°.

The time required for the complete deposition of the zinc does not

exceed 5½ hours; the deposit is free from manganese. It is rapidly washed first with water, then successively with alcohol and ether, dried in the water oven for 5 minutes, and weighed.

L. DE K.

Direct Estimation of Aluminium in the Presence of Iron, Manganese, Calcium, and Magnesium. By WILLIAM H. HESS and EDWARD D. CAMPBELL (*J. Amer. Chem. Soc.*, 1899, 21, 776—780).—A convenient bulk of the liquid, preferably containing the metals as chlorides, is heated to boiling and dilute ammonia is added so long as the precipitate readily redissolves; to reduce the ferric salts, a saturated solution of ammonium hydrogen sulphite is added drop by drop until the liquid is colourless. The aluminium is now precipitated by adding a few c.c. of phenylhydrazine and is washed with hot water containing about 10 per cent. of phenylhydrazine hydrogen sulphite free from excess of sulphur dioxide. On ignition, it leaves pure alumina. Chromium may also be separated from iron, calcium, magnesium, cobalt, or nickel in this manner.

If, however, the mixture also contains phosphoric acid, the alumina will be contaminated with phosphoric oxide, which must be estimated and allowed for.

L. DE K.

Volumetric Estimation of Manganese. By RODOLFO NAMIAS (*Chem. Centr.*, 1899, i, 1224; from *Annuar. Soc. chim. Milano*, 1899, 54—56).—The author uses Volhard's process when estimating manganese in samples of iron or steel. Use is made of carefully selected crystals of potassium permanganate which are reduced by boiling with hydrochloric acid; the manganous chloride so obtained is precipitated with sodium carbonate, the precipitate is converted into manganoso-manganic oxide, and this is titrated with ferrous sulphate.

It is recommended to first dissolve the steel, or iron, in hydrochloric acid before oxidising with nitric acid to prevent the formation of organic compounds, which reduce permanganate.

L. DE K.

A Simplified Reductor. By PORTER W. SHIMEE (*J. Amer. Chem. Soc.*, 1899, 21, 723—724).—A new form of the reductor used in the estimation of iron and phosphomolybdate solutions. It is essentially a plain glass tube $\frac{3}{8}$ -inch in diameter and 20 inches long drawn out and out off at the lower end. It is united with a 4-inch funnel by means of wired rubber tubing fitted with a screw clamp. The lower end passes through a soft two-hole stopper of a thick-walled pint gas bottle connected with a filter pump through an intermediate safety bottle and valve. The passage of the solution through the reductor may be effected either by use of the pump or by Bunsen's device of condensing steam.

The tube is filled by placing a few small pieces of broken glass in the drawn out portion, then a little clean sand and finally about 3 ounces of amalgamated zinc. The speed of filtration is regulated by the upper clamp; a reduction takes about five minutes.

L. DE K.

Separation of Iron from Chromium, Zirconium, and Beryllium by the Action of Hydrogen Chloride on the Oxides. By FRANK S. HAYENS and ARTHUR F. WAY (*Am. J. Sci.*, 1899, 8, 217—218).—Gooch and Havens (Abstr., 1897, ii, 232) have shown that iron

le may be readily separated from alumina by heating the mixed des in a current of hydrogen chloride at a temperature of 450—500°; o the mixture of sodium chloride and sulphuric acid a small quantity manganese dioxide is added so as to also generate a little chlorine, ; decomposition may be effected at 200—300°.

The authors now state that this method may be used successfully for a separation of oxide of iron from the oxides of chromium, zirconium, d beryllium.

L. DE K.

Estimation of Nickel in Nickel-steel. By GEORGE W. SARGENT (*Amer. Chem. Soc.*, 1899, 21, 854—857).—The metal is dissolved in hydrochloric acid, oxidised with nitric acid, and the solution evaporated to dryness; the residue is taken up with a little dilute hydrochloric acid, and filtered into a separating funnel. The bulk of the ferric chloride is now removed by agitating the liquid with ether (Chase's method) and the solution, after removal of the dissolved ether, reprecipitated by bromine water and ammonia; the precipitate is freed from nickel by a second solution and precipitation. The combined filtrates containing the nickel are acidified with hydrochloric acid, freed from any copper by hydrogen sulphide, the filtrate boiled to expel hydrogen sulphide, and, when cold, a slight excess of ammonia added, and the liquid titrated with standard potassium cyanide, with silver iodide emulsion as indicator (Campbell and Andrew's method, *Abstr.*, 1895, ii, 421).

L. DE K.

[Estimation of Chromic Acid in Acetylene Purifiers.] By FRITZ ULLMANN and IRMA GOLDBERG (*Chem. Centr.*, 1899, ii, 19—20; from *J. Gasbel.*, 42, 374—377).—See this vol., i, 1.

Estimation of Antimony in Ores. By THOMAS BROWN, jun. (*J. Amer. Chem. Soc.*, 1899, 21, 780—789).—*Assay of soluble ores such as Stibnite and Senarmontite.*—1 gram of the finely powdered sample is boiled in a covered beaker with 25 c.c. of strong hydrochloric acid until about 15 c.c. are left. 2 grams of tartaric acid are then added, and when dissolved, about 4—6 drops of strong nitric acid are introduced, and the boiling continued for a minute. The mixture is then diluted with water, the insoluble residue well washed on a filter, and the filtrate diluted to about 250 c.c. The liquid is now saturated with hydrogen sulphide and gently heated, and after remaining for an hour, the antimony sulphide is collected and washed with cold water. If there is any probability of lead being present, the precipitate must be dissolved in ammonium sulphide and the filtrate reprecipitated with dilute hydrochloric acid. The precipitate is collected on a counterpoised (double) filter, washed, dried at 110°, and weighed; the bulk of the crude antimony sulphide is transferred to a weighed platinum boat, and then placed inside a piece of combustion tube and heated in a current of carbon dioxide, so as to convert it into black antimony sulphide, which is then weighed. A correction is finally made for the small amount of sulphide not removable from the filter.

Assay of insoluble ores such as Cervantite.—1 gram of the powdered ore is mixed in a covered porcelain crucible with 10 grams of a mixture of equal parts of sulphur and dry sodium carbonate, covered with a little more of this flux, and fused for 10 minutes in a muffle. The mass

is extracted with water, and in the filtrate the antimony is precipitated as sulphide by means of hydrochloric acid; the crude sulphide is then treated as previously directed.

Assay of partially soluble ores: Oxy-sulphides.—These are assayed by the combination of the two processes described.

The fire assay (fusion with potassium cyanide), although easy of execution, seldom agrees with the wet assays, and is particularly unsuitable for ores containing sulphur. L. DE K.

Apparatus for the Preparation of Plant-Ash for Analysis. By G. M. TUCKER (*Ber.*, 1899, 32, 2583—2585).—This is a simplified form of Shuttleworth's apparatus (*Diss. Göttingen*, 1899, and *J. Landwirthschaft*, 1899, 173) designed to give a control over any loss of potash, chlorine, &c., by volatilisation. The platinum vessel, in which the plant is burnt, is of a conical form and is provided with a closely-fitting cover having two apertures. In the central aperture is soldered a tube passing to the bottom of the vessel and down this tube, by means of which air enters, passes the handle of a stirrer. By means of the other aperture, the gases from the combustion chamber are led through a small wash-bottle, beyond which is an aspirator which draws air through the whole apparatus. Any ash mechanically carried by the air stream is stopped by a loose movable cap fitted to the exit tube. The conical shape of the vessel allows of more uniform heating, which is carried out first in a conical sand-bath, and, later, over a bare flame, the vessel being then fitted into a hole in an asbestos card. T. H. P.

Ammoniacal Copper Solutions and Hydroxylamine as a Test for Acetylene. By LUDWIG ILOSVAY VON NAGY ILOVA (*Ber.*, 1899, 32, 2697—2699).—Ammoniacal copper solutions decolorised by reducing with hydroxylamine can be used for detecting acetylene, but the value of the reagent and the colour of the precipitate depend on the proportions used. The quantities recommended are, for 50 c.c. of solution, (I) cupric chloride ($+ 3\text{H}_2\text{O}$), 0.75 gram; ammonium chloride, 1.5 grams; aqueous ammonia (20—21 per cent.), 3 c.c., hydroxylamine hydrochloride, 3 grams. (II) cupric nitrate ($+ 5\text{H}_2\text{O}$), 1 gram; aqueous ammonia, 4 c.c., hydroxylamine hydrochloride, 3 grams. (III) copper sulphate ($+ 5\text{H}_2\text{O}$), 1 gram; aqueous ammonia, 4 c.c., hydroxylamine hydrochloride, 3 grams. The reagent gives a splendid red precipitate with acetylene, but begins to deteriorate after three days. T. M. L.

A Colour Test for the Detection of Methyl Alcohol. By EDMOND JANDRIER (*Chem. Centr.*, 1899, i, 1296; from *Ann. chim. anal. appl.*, 4, 156).—Resorcinol recommended by Mulliken and Scudder (*Abstr.*, 1899, ii, 388) gives, with acetaldehyde, almost the same colour as with formaldehyde, and is consequently not a safe test for the detection of methyl alcohol; the test is also interfered with by the presence of furfuraldehyde. It is proposed to use gallic acid instead, as recommended by Barbet and Jandrier (*Abstr.*, 1898, ii, 265).

L. DE K.

Recognition of Marc Wines (Tresterweine). By WILHELM FRESSENIUS and LEO GRÜNHUT (*Zeit. anal. Chem.*, 1899, 38, 472—512).—Wines obtained by the fermentation of solutions of glucose in

contact with grape marc (*Trester*) have hitherto not been distinguishable with certainty by chemical analysis from natural wines. The authors believe they have discovered a trustworthy criterion of such wines in the fact that they contain little or no tartaric acid combined with alkaline earths, whilst natural white wines always contain calcium tartrate to an extent which permits a limit of about 0.1 gram of tartaric acid per 100 c.c. to be established. The recognition of this fact in their composition depends on the estimation of the ratio of the total tartaric acid to the total alkalinity of the ash and the alkalinity of the portion of the ash soluble in water. With reference to the observations of Kulisch, Kohlmann, and Höppner (*Abstr.*, 1899, ii, 341; also 1895, ii, 465) on this subject, they point out that, in the estimation of the soluble constituents of the ash, a very limited amount of washing (30—80 c.c. of hot water for the ash of 100 c.c. of wine) must be employed, so as to leave the calcium carbonate of the ash as far as possible undissolved. Formulæ are given for calculating the analytical data. An exception to the above rule occurs in the case of marc wines to which tartaric acid has been added during manufacture. Red wines also contain much smaller proportions of calcium tartrate than white wines. The above criterion must therefore in all cases be considered in connection with other characteristics of marc wines, namely, a high proportion of ash to total solids, high percentage of tannin, and occasionally also of volatile acids. It can likewise only be employed in cases where the ash of the wine exhibits a normal total alkalinity and the proportion of sulphate is not abnormal, since it is obvious that excessive sulphuring would disturb the relations of the various tartrates in the wine. The alkalinity factor of natural wines, that is, the alkalinity of 0.1 gram of the ash expressed in cubic centimetres of normal alkali, seldom exceeds 0.8 or 1.0. Wines exhibiting a much lower alkalinity factor should be examined for excessive sulphuration. A much higher factor would suggest a search for added organic acids. The ratio of glycerol to alcohol in marc wines seems generally to exceed the limit of 7:100 laid down for natural wines.

With regard to the use of the large proportion of tannin as a criterion of marc wines, it is evident that no limit can be laid down, since the proportion of tannin in natural wines varies widely. Barth has argued that the ratio of total extract (after deduction of sugar, ash, and non-volatile acids) to tannin may be regarded as constant, and employs the factor 5 for multiplying the tannin. The authors show, however, that in a great number of natural wines, even the factor 4 would be too high and point out the need for further investigations of this subject.

The authors also give a complete analysis of the ash of a marc wine prepared by themselves, and some analyses of raisin-wines, one of which they also manufactured.

M. J. S.

Volumetric Estimation of Alcohols, especially of Fusel-Oil in "Brandies." By FRANZ ADAM (*Chem. Centr.*, 1899, i, 1226—1227; from *Oesterr. Chem. Zeit.*, 2, 241—243).—A solution of acetyl chloride in chloroform, after it has been well shaken with water and so

decomposed into acetic and hydrochloric acids, is titrated with normal alkali. Another portion of the chloroform solution is allowed to act on the alcohol, whereby it is partly decomposed into hydrogen chloride and alkyl acetate; after decomposing the remainder with water, the titration is repeated, and the difference in alkali represents the amount of the alcohol. To estimate amyl alcohol in brandy, the sample is diluted to 20 per cent. strength by volume, and the fusel oil then extracted by repeated agitation with pure chloroform. This is repeatedly shaken with water, then dried over burnt gypsum and treated with standard solution of acetyl chloride, &c. The process is also suitable for the estimation of the alcohol number of ethereal oils.

L. DE K.

Action of Bromine on Phenol and Cresols with Reference to the Analysis of Mixtures of these Compounds. By HUGO DITZ and FRANZ CEDIWODA (*Zeit. angew. Chem.*, 1899, 873—877 and 897—903).—An alkaline solution of a phenol is mixed with a known excess of bromine dissolved in caustic potash, acidified with dilute HCl (1:1), shaken vigorously for 1 minute, and titrated with standard thiosulphate solution in the presence of potassium iodide; under these conditions, 1 mol. of *o*-cresol or *p*-cresol takes up 2 atoms of bromine, whilst *m*-cresol and phenol each combine with 3 atoms. In the case of *p*-cresol, it is essential that the duration of the experiment should not exceed the prescribed time limit, otherwise the amount of bromine required exceeds 2 atoms. When the alkaline solution of a phenol and excess of bromine is acidified with concentrated sulphuric acid, allowed to remain for 10 minutes, subsequently shaken for 5 minutes, and then filtered through glass wool or sand, it is found, by treating the filtrate with potassium iodide and titrating with thiosulphate, that the amount of bromine taken up corresponds with 3 atoms in the case of *o*-cresol and *p*-cresol, and with 4 for *m*-cresol and phenol. These results are applied to the analysis of mixtures of two or more of these constituents. The mixture of the phenols is separated from other impurities by extraction with ether; the ethereal extract is dried over calcium chloride or dry sodium sulphate, distilled up to 180° to remove ether and last traces of moisture, the fraction distilling over above this temperature is treated with bromine by the two methods just described, and the amount of phenol, *m*-cresol and mixed ortho- and para-cresol determined by means of the following equations: (i) $x + y + z = a$; (ii) $3\text{Br}/94 \cdot 06 \cdot x + 2\text{Br}/108 \cdot 08 \cdot y + 3\text{Br}/108 \cdot 08 \cdot z = b$; and (iii) $4\text{Br}/94 \cdot 06 \cdot x + 3\text{Br}/108 \cdot 08 \cdot y + 4\text{Br}/108 \cdot 08 \cdot z = c$, where x and z represent the amounts of phenol and *m*-cresol, y the amount of the mixture of the ortho- and para-isomerides, a the total quantity of phenolic compounds, b the amount of bromine absorbed when the solution is acidified with dilute hydrochloric acid, and c the amount taken up when concentrated sulphuric acid is employed, and the bromo-derivatives filtered off before titration.

G. T. M.

Simplification of the Phenylhydrazine Test [for Sugar in Urine.] By ALBERT KOWARSKY (*Chem. Centr.*, 1899, i, 1294; from *Berl. klin. Wochschr.*, 36, 412—414).—5 drops of pure phenyl-

hydrazine are mixed with 10 drops of glacial acetic acid and 1 c.c. of brine, and the mixture boiled for 2 minutes with 3 c.c. of the supposed diabetic urine and then allowed to cool slowly. If the characteristic osazone crystals form after a few minutes, the urine is practically free from sugar. If appreciable traces of albumin are present, these must be first removed by coagulation at the boiling heat.

L. DE K.

Stability of Gun-Cotton and Smokeless Powder. By C. HORTSEMA (*Zeit. angew. Chem.*, 1899, 705—710).—A review of the methods in use for testing these explosives as to their keeping powers.

The author thinks that at present there are not sufficient grounds for substituting the Simon-Thomas test for those of Abel and of Guttman. For comparison, a stock of materials of guaranteed make and of known age should be kept.

L. DE K.

Chemistry of Butter-Fat. II. Chemical Composition of Butter-Fat. By C. A. BROWNE, jun. (*J. Amer. Chem. Soc.*, 1899, 21, 807—827. Compare Abstr., 1899, ii, 709).—This is a long investigation as to the true composition of butter-fat; on the whole, the article does not lend itself to useful abstraction.

The following analysis of the fatty acids obtained from 100 grams of butter is interesting as it confirms the result of Hehner and Mitchell (Abstr., 1897, ii, 287) as to the small proportion of stearic acid contained in butter: dihydroxystearic, 1.00; oleic, 32.50; stearic, 1.83; palmitic, 38.61; myristic, 9.89; lauric, 2.57; capric (decoic), 0.32; caprylic (octoic), 0.49; caproic (hexoic), 2.09; butyric acid, 5.45; total, 94.75.

L. DE K.

The Reichert Number of Butter. By JAMES H. STEBBINS (*J. Amer. Chem. Soc.*, 1899, 21, 938—940).—From the result of 317 analyses of genuine butters, the author is in favour of placing the lowest allowable limit of the Reichert number at 11.5.

L. DE K.

Analysis of Bees Wax. By ANGIOLO FUNARO (*L'Orosci*, 1899, 22, 109—123).—The adulterants of bees wax are Japan and Carnaüba wax, animal fats, stearic acid, resins, cerasin, and paraffin wax. The various methods for detecting and estimating these impurities are described in detail and discussed.

T. H. P.

The Sesamé Oil Reaction and Sesamé Butter. By KARL BERNHARD SOHN (*Bied. Centr.*, 1899, 28, 298—299; from *Milchzeit.*, 1898, 498).—The employment of pure furfuraldehyde which has been recently distilled in a vacuum, and is colourless, is of great importance in testing for margarine by means of the Baudouin test. In case pure furfuraldehyde is not available, the employment of furfuramide is recommended.

The following process for detecting for sesamé oil is given: the melted filtered butter (10 c.c.) is extracted with hydrochloric acid of sp. gr. 1.125 three or four times or until the acid remains colourless. Five c.c. of the butter fat is then shaken with a solution of 1.08 grams of furfuramide in 100 c.c. of absolute alcohol (0.1 c.c.) and hydrochloric acid of sp. gr. 1.19 (10 c.c.) for at least half a minute. If the fat solidifies, it is heated at 60—70°. If the hydrochloric acid

shows a red coloration which does not soon disappear, sesamé oil is proved to be present; with small amounts of sesamé oil, the coloration takes hours to appear.

N. H. J. M.

[Testing Butter for Oil of Sesamé.] By H. WEIGMANN (*Bied. Centr.*, 1899, 28, 629).—See this vol., ii, 40.

Detection and Estimation of Formaldehyde in the Free State and in its Compounds. By G. H. A. CLOWES and BERNHARD TOLLENS (*Ber.*, 1899, 32, 2841—2848).—Formaldehyde is estimated by heating with phloroglucinol and hydrochloric acid at 70—80° and weighing the phloroglucide, $C_7H_5O_3$, which is produced under these conditions. In most of its compounds, the formaldehyde can be estimated in this way by using hydrochloric acid and water, but in some cases it is necessary to employ a more or less concentrated sulphuric acid to hydrolyse the methylene compound. A large number of analytical results are given.

T. M. L.

[Separation of Acetone from Acetoacetic and Acetonedicarboxylic Acids]. By LUIGI SABBATANI (*Chem. Centr.*, 1899, ii, 22—23; from *Atti Real. Accad. Torino*, 34).—See this vol., ii, 32.

New Reaction of Acetone and a New Method for the Detection of Aliphatic Amines. By ENRICO RIMINI (*L'Orosi*, 1899, 22, 40—44).—If to a mixture of an aliphatic monamine with a 10 per cent solution of acetone a few drops of a concentrated solution of sodium nitroprusside are added, a magenta coloration is formed, which gradually becomes more and more intense and lasts for several hours; the addition of a few drops of acetic acid changes it to an intense violet. When the hydrochloride of the amine is employed, too much alkali must not be added, as in this case the orange tint of Legal's reaction is obtained; this, however, vanishes much more quickly than the red coloration. By using aniline or phenylhydrazine in place of the aliphatic monamine, no coloration is obtained, whilst benzylamine gives a faint violet colour which forms slowly. With secondary aliphatic monamines, Legal's reaction takes place, whilst tertiary amines act simply as alkalis.

No coloration is obtained if, instead of acetone, one of the following substances is employed:—formaldedyde, acetaldehyde, paraldehyde, isobutaldehyde, or valeraldehyde, chloral, benzaldehyde, salicylaldehyde, anisaldehyde or cinnamaldehyde, furfuraldehyde, dextrose, acetophenone, benzophenone, ethyl acetoacetate, camphor, fenchone, or tanacetone; with concentrated solutions of pyruvic acid, a brown coloration forms and changes to green, whilst with dilute solutions a ponceau tint is developed.

The presence of 1/10 per cent. of acetone in a solution can be detected in this way, and the formation of the colour is not interfered with by the presence of alcohol or acetaldehyde.

Use is made of this reaction of acetone and of that of acetaldehyde formerly described (*Rendiconti Amministr. Civile. Ministero del Interno*, 1898) by the author to distinguish between primary and secondary aliphatic amines. The formation of an azure coloration on adding sodium nitroprusside and aldehyde to the solution of an amine, shows

that the base is secondary, whilst if acetone is added in place of the aldehyde, and a magenta tint is given to the liquid, the amine is primary. These reactions are obtained in mixtures of primary, secondary, and tertiary amines.

T. H. P.

Volumetric Estimation of Quinones Derived from Benzene. By AMAND VALEUR (*Compt. rend.*, 1899, 129, 552—553).—The method described is based on the reduction of quinones by hydriodic acid, all secondary reactions being avoided by operating in the following manner. A cooled mixture of 20 c.c. of concentrated hydrochloric acid with an equal volume of 95 per cent. alcohol is quickly added to 20 c.c. of a 10 per cent. aqueous solution of potassium iodide. The liquid is then poured into the alcoholic solution of the quinone and the iodine liberated is titrated with *N*/10 sodium thiosulphate solution. The process is expeditious, and is shown to give accurate results in the case of quinone, dichloroquinone, toluquinone, and thymoquinone; it is also applicable to unstable compounds of quinones, such as phenokinones and quinhydrone.

N. L.

A Colour Reaction to Distinguish the Hydrochlorides of *m*-Phenylenediamine and *p*-Phenylenediamine. By L. CUNIASSE (*Chem. Centr.*, 1899, i, 1297; from *Ann. chim. anal. appl.*, 4, 156—157).—The meta-compound, when heated in aqueous solution with a few drops of a 1 per cent. solution of acetaldehyde in proof-spirit slightly acidified with acetic acid, yields, when cold, a splendid yellow coloration with a strongly green fluorescence. The para-compound turns orange-red without any fluorescence.

L. DE K.

Estimation of Urea in the Tissues: and the Amount contained in the Liver. By RUDOLF GOTTLIEB (*Chem. Centr.*, 1899, i, 1298; from *Arch. Exp. Path. Pharm.*, 42, 238—249).—The urea is first isolated as a mercuric compound by von Schroeder's process; finally, the alcoholic solution of the urea is precipitated by an ethereal solution of oxalic acid and the acid contained in the urea oxalate found by titration.

The blood of starving dogs contains 0.011—0.02 per cent. of urea; when on meat diet, it increases to 0.033—0.056 per cent. The liver, contrary to expectation, contains only 0.008—0.02 per cent.

L. DE K.

Detection of "Saccharin" in Wines. By DIOSCORIDE VITALI (*Chem. Centr.*, 1899, i, 1297—1298; from *Boll. Chim. Farm.*, 38, 297—300).—The only trustworthy method is based on the conversion of the sulphur of "saccharin" into sulphate.

Small quantities of "saccharin" may be estimated by precipitation with mercuric nitrate. The precipitate is then weighed and the amount of mercuric oxide in it estimated, the difference representing the "saccharin."

L. DE K.

Employment of Chloral Hydrate in the Estimation of Alkaloids. By EDUARD SCHAEER (*Zeit. anal. Chem.*, 1889, 38, 469—472).—The author completely confirms Lenz's opinion (*Abstr.*,

1899, ii, 391) as to the value of chloral hydrate for the extraction of the vegetable alkaloids from plant products, especially when large proportions of resins and ethereal oils are present. A still more powerful solvent, especially for solid fats and waxes, is a concentrated alcoholic solution of chloral alcoholate. Mauch has made the observation that the salts of the alkaloids are dissolved by aqueous chloral hydrate as readily as the free bases. A difficulty is, however, encountered in the extraction of strychnine from nuxvomica seeds and Ignatius beans, in consequence of the presence of mucoid compounds, which (in common with certain varieties of starch and also animal gelatin) swell up in chloral hydrate, and render it viscous. Caoutchouc and gutta percha also resist completely the solvent action of chloral hydrate, and, when they are present to a large extent, no advantage results from the use of chloral.

Mauch asserts that when the chloral hydrate solutions of the bases are warmed, the bases are often converted into formates. So far as the author's experience extends, the chloral solutions of the alkaloid salts exhibit great permanence, and, may be heated on the water-bath without loss of alkaloid.

M. J. S.

The Chromic Acid Test for Cocaine. By GEORGE L. SCHAEFER (*J. Amer. Chem. Soc.*, 1899, 21, 936—938. Compare Abstr., 1899, ii, 715).—In reply to the criticisms of Squire (*Chemist and Druggist*, April 22), Cowmley (*Pharm. J. Trans.*, April 15), and Merck (*Pharm. Zeit.*, No. 42), the author upholds his own chromate process.

L. DE K.

The Active Principle of Cayenne Pepper. By KARL MICKO (*Chem. Centr.*, 1297; from *Zeit. Unters. Nahr.-Genußsm.*, 2, 411—412. Compare Abstr., 1899, i, 716).—Capsacutin described by Mörbitz is probably the same compound as the author's capsaicin, $C_{18}H_{18}O_3N$, the active principle of *Capsicum annuum*, L., and *Capsicum fastigiatum*, Bl.

Reactions of capsaicin.—When moistened with neutral solution of ferric chloride and a little alcohol, insoluble, greenish-blue drops are noticed, but this test is not particularly delicate. Strong sulphuric acid and a particle of sugar cause, after some hours, a fine violet coloration. When heated on the water-bath with strong hydrochloric acid, an alkaloidal substance is obtained which yields precipitates with platinic chloride, iodine, and potassium mercuric iodide.

L. DE K.

Detection of Nucleo-albumin in Urine by means of Tannin. By LÉON GARNIER and L. MICHEL (*J. Pharm.*, 1899, [vi], 10, 150—152).—The precipitate produced when tannin (Almén's reagent) is added to urine previously diluted with its own volume of a saturated solution of sodium chloride, consists chiefly of tannin with a small amount of sodium chloride and traces of nitrogenous substances. The phosphates present in the urine cause the precipitation of the tannin. Ott's statement (*Jahresber. für Thierchemie*, 1895, 567) that the formation of this precipitate is a sure test for the presence of nucleo-albumin is thus proved to be erroneous.

H. R. LE S.

Estimation of the Products of Digestion with Pepsin. By JEAN EFFRONT (*Chem. Zeit.*, 1899, 23, 770—771 and 783—784).—A solution of tannin in tartaric acid may be employed for separating proteoses and peptones, as proteoses are precipitated and peptones remain in solution; its use is suggested as a reagent in the analysis of the products of peptonisation. For a complete analysis, the following determinations should be made: 1, total nitrogen; 2, total proteids; 3, syntonins; 4, proteoses; 5, peptones. For the total proteids, the solution is precipitated with phosphotungstic acid, the precipitate washed with $N/2$ hydrochloric acid and dried without removal from the filter; the nitrogen in this precipitate is estimated, and the number thus obtained multiplied by 6.25 gives the total proteids. Syntonins may be estimated by exactly neutralising the solution with sodium hydroxide (1:10), or even more correctly by estimating the total proteids in the original solution and then in the neutralised solution, the difference between the two determinations giving the percentage of syntonins. Proteoses may be precipitated by a tartaric acid solution of tannin after the albumin is first removed by coagulation, and the syntonins by neutralisation. The solution is made by dissolving tannin (50 grams) in water (500 c.c.) adding N -sodium hydroxide (50 c.c.), making up to 1 litre, and then adding 15 c.c. of a 10 per cent. tartaric acid solution. The precipitate is well washed, then dried between filter-paper, and the percentage of nitrogen determined. The peptones which remain in solution may be precipitated by phosphotungstic acid.

The percentages of peptoses obtained by salting out with zinc sulphate, and by precipitating with a tartaric solution of tannin, are not concordant when the proteid solution has undergone an appreciable amount of peptonisation.

The results obtained also indicate that phosphotungstic acid is an uncertain reagent for estimating peptones. It appears that, after prolonged peptonisation, the peptones are no longer precipitated by this reagent, and it is concluded that the compounds known as peptones are really substances of very different characters, some of which are precipitated by the phosphotungstic acid reagent and others not, and, further, that peptones themselves are acted on by pepsin.

The process of analysis described above gives accurate results only when peptonisation has proceeded for a short time. J. J. S.

Analysis of Glue and Leather. By WILHELM FAHRION (*Chem. Zeit.*, 1899, 23, 452—453).—Glue and leather contain a small quantity of fatty matter, which, however, is partially oxidised, and incompletely soluble in light petroleum. To estimate fat in glue, 10 grams of the cut-up sample are heated with 40 c.c. of 8 per cent. alcoholic potash on the water-bath, adding some more alcohol if necessary, and finally evaporating to dryness. The residue is then dissolved in hot water and rendered acid with hydrochloric acid. The liquid is heated nearly to boiling for half-an-hour, then transferred to a separating funnel, and, when cold, shaken with ether and then left to settle overnight. The aqueous layer is drawn off, the ether poured off, and the hydroxy-acids which adhere to the sides of the funnel are dissolved in hot

alcohol. Both the ethereal and alcoholic solutions are then evaporated in the same tared dish.

Alcoholic potash is also useful in leather analysis. The rasped sample is first extracted with light petroleum to obtain the bulk of the fat. It is then treated with alcoholic potash as described, but on faintly acidifying with hydrochloric acid, a precipitate of tannin and its derivatives (phlobaphens) is obtained which occludes some more fat, and also any hydroxy-acids. The fat may be extracted with ether, but as yet a process is not known for the separation of fatty hydroxy-acids from the tannin precipitate. The latter may be dried and weighed, but as it always contains mineral matters, it must be finally burnt to ash.

L. DE K.

Estimation of Humus in Soils. By C. ASCHMAN and HAROLD FABER (*Chem. Zeit.*, 1899, 23, 61).—25 grams of the finely divided air-dried sample are put into a porcelain dish and heated for 1 hour on the boiling water-bath with 100 c.c. of aqueous caustic soda (50 grams per litre); the liquid is poured off and the extraction repeated several times. The whole, including the deposit, is then made up to 510 c.c. (10 c.c. being occupied by the insoluble matter) and after the supernatant liquid has become clear, an aliquot part is syphoned off and tested as follows: 0.125 gram of humic acid (*acid. huminic. pur.*) is dissolved in soda solution and diluted to 500 c.c.; 5 c.c. are diluted to 100 c.c., 10 c.c. of dilute sulphuric acid (1:5) added, and the liquid boiled with addition of solution of potassium permanganate (0.32 gram per litre) until the colour is no longer discharged. 10 c.c. of a solution of oxalic acid (0.63 gram per litre) are now added and the excess of oxalic acid titrated back with the permanganate solution. The usual blank experiment is then made, and having thus found the humic acid value of the permanganate, the amount of humic acid in the soil may be ascertained by titration. For the success of the experiment, it is necessary that the amount of the humic acid present in the aliquot part of the solution of the sample shall not materially differ from the amount used in the standardising experiment.

L. DE K.

Analyses of Ginger. By EDWY G. CLAYTON (*Analyst*, 1899, 24, 122—125).—The author has analysed 37 samples of ginger from various sources (some of them being again analysed after steeping in water or proof spirit) and has tabulated the results.

The analysis comprises the following estimations: soluble and insoluble ash; the extracts obtained with cold water, ether, absolute alcohol (after complete extraction with ether), and light petroleum respectively; essential oil; alkalinity calculated as potash, and chlorine in the soluble ash; in certain cases, the ash, alkalinity of the ash, chlorine in the cold water extract, water, and silica were also determined.

It appears that the commercial processes—washing, scraping, cutting, grinding, and separation of fibre—do not so alter the composition of genuine ginger as to convey the idea that it has been adulterated with spent ginger, except in some cases where excessive washing had occurred.

L. DE K.

General and Physical Chemistry.

Electrical Conductivity of Alkali Chlorides and Nitrates. By FRIEDRICH KOHLRAUSCH and MARGARET E. MALBY (*Chem. Centr.*, 1899, ii, 465—466; from *Sitz. Kgl. Akad. Wiss. Berlin*, 1899, 665).—With the view of testing the theoretical connection between molecular conductivity and ionic migration, the conductivities in dilute solution of the chlorides and nitrates of potassium, sodium, and lithium have been determined with the greatest care. The numbers in the following table give the equivalent conductivities at 18° for solutions of the concentration m , and represent the mean of several determinations, which agreed on the average to 1/4000th.

m .	KCl.	NaCl.	LiCl.	KNO ₃ .	NaNO ₃ .	LiNO ₃ .
0·0001	129·05	108·06	98·06	125·49	104·53	94·38
0·0002	128·76	107·80	97·78	125·18	104·18	94·07
0·0005	128·09	107·18	97·13	124·44	103·53	93·45
0·001	127·33	106·48	96·45	123·64	102·85	92·80
0·002	126·29	105·55	95·55	122·59	101·88	91·91
0·005	124·40	103·79	93·86	120·47	100·07	90·27
0·01	122·42	101·95	92·08	118·20	98·16	88·55
0·02	120·00	99·66	89·88	115·27	95·70	86·38
0·05	115·94	95·86	86·22	110·09	91·60	82·86
0·1	112·00	92·01	82·35	104·77	87·24	79·24
0·2	107·96	87·73	77·93	98·74	82·28	75·06
0·5	102·40	80·93	70·65	89·23	74·05	68·03
1·0	98·28	74·34	63·30	80·47	65·86	60·80

For solutions up to and including the concentration $N/500$, each ion has a specific conductivity, which depends on the concentration alone; up to $N/10$ solution, the deviations from this rule amount to ± 1 per cent. As a rule, the fall of ionic conductivity with increasing concentration is most rapid in the case of ions with high migration velocity, but no general and simple law can be laid down. Within the same limits, the fall of conductivity is, in the cases of potassium and sodium, more rapid for the nitrate than for the chloride; in the case of lithium, more rapid for the chloride than for the nitrate.

J. C. P.

Change of Free Energy in Fused Halogen Compounds of some Heavy Metals. By RICHARD LORENZ (*Zeit. anorg. Chem.*, 1899, 22, 241—255. Compare Abstr., 1899, ii, 269).—In determining the E.M.F. of polarisation for a number of fused salts (Abstr., 1899, ii, 267), Czepinski found the temperature coefficient abnormally large at higher temperatures. Further investigation by Weber (Abstr., 1899, ii, 724) has shown that this coefficient dE/dT is regular, even up to high temperatures, when the electrodes are kept far enough apart; the necessity for this is due to the diffusing and penetrating power of the halogen and the metallic vapour.

Differentiation of the equation $E = Q + T.dE/dT$ leads to the relation $-dQ/dT = T.d^2E/dT^2$. Thus, when dE/dT is constant, Q must also be constant. This relation is approximately fulfilled in the case of lead chloride, so that the molecular heat of the compound is very nearly the sum of the atomic heats of the components. On the assumption that this relation holds exactly, the E.M.F. may be extrapolated for ordinary temperatures. The value thus calculated for the E.M.F. of the system $Pb | PbCl_2 | Cl_2$ is 1.65 volts, agreeing with the value 1.59 volts for the E.M.F. of decomposition of lead chloride in solution, calculated by Bodländer from its solubility.

The paper also discusses the ionic concentrations in fused salts, leading to the conclusion that the dissociation of fused silver chloride is rather more than twice that of fused lead chloride. J. C. P.

Coagulative Power of Electrolytes. By W. C. DAMPIER WHETHAM (*Phil. Mag.*, 1899, 48, 474—477).—The coagulative power of an electrolyte may be taken as inversely proportional to the number of gram-equivalents necessary to produce immediate coagulation in a given solution of a colloid. The coagulative powers of sulphates with uni-, bi-, and ter-valent ions stand in the ratio 1 : 35 : 1023 (compare *Trans.*, 1895, 67, 63), those of chlorides in the ratio 1 : 30 : 1650. There is certainly an intimate connection between the coagulative power and the electrical properties of a solution, and it may be supposed that to produce coagulation a certain minimum electrical charge is necessary. Further, as the electrical charge on an ion is proportional to its valency, equal charges are carried by $2n$ triads, $3n$ dyads, or $6n$ monads. On this basis, it is shown that the coagulative powers of uni-, bi-, and ter-valent ions in equivalent solution are in the ratio $1 : x : x^2$, agreeing well with the numbers just quoted. If this view is correct, the coagulative power of a quadri-valent metallic sulphate would be about 30,000 times as great as that of a sulphate with a univalent ion. J. C. P.

Application of the Dissociation Theory to the Electrolysis of Aqueous Solutions of Two Electrolytes with One Common Ion. By JAMES G. MACGREGOR (*Chem. Centr.*, 1899, ii, 82; from *Trans. Roy. Soc. Canada*, [ii], 4, 117—148).—The author has calculated the values of the dissociation in solutions of mixed electrolytes with one common ion, and obtained from these values the ratio of the transference numbers of the other two ions, the values so resulting being compared with those obtained by Hopfgartner (*Abstr.*, 1898, ii, 151). The agreement was satisfactory in the cases of solutions of sodium and hydrogen chlorides, potassium chloride and iodide, and barium and hydrogen chlorides. Agreement was not obtained in the case of solutions of copper and hydrogen sulphates, but this is explicable by the dissociation of the acid into H and HSO_4 ions as well as into H_2 and SO_4 ions. L. M. J.

Theory of the Electrolytic Solution Pressure. By R. A. LEHFELDT (*Phil. Mag.*, 1899, 48, 430—433).—The electrolytic solution pressure, Π , of a metal is calculated from the observed E.M.F.

between the metal and the solution in which it is immersed by the equation $E = RT/\epsilon \log_e \Pi/P$, where ϵ is the quantity of electricity associated with 1 gram-equivalent, and P is the osmotic pressure of the metallic ions in the solution. For zinc, Π has the very high value 9.9×10^{13} atmospheres. An expression is obtained for the tension due to the electrical double layer between the metal and the ions in solution, leading to the equation, $x = \sqrt{D\Pi/2\pi\epsilon^2}$, where x is the number of gram-equivalents that go into solution per sq. cm. of surface, and D the dielectric constant of the medium. From this equation, it may be shown that in order to produce the solution pressure attributed to zinc, 1.27 grams of the metal would have to pass into the ionic form per sq. cm. immersed, a conclusion which is not borne out by observation. Besides this difficulty with regard to the electrolytic solution pressure of zinc, there is one of another kind in the case of palladium, for which $\Pi = 1.5 \times 10^{-36}$; the smallness of this value involves the rejection of the molecular theory of fluids.

J. C. P.

Thermal Conductivity in Gases. By M. SMOLUCHOWSKI R. VON SMOLAN (*Chem. Centr.*, 1899, ii, 353, from *Oesterr. Chem. Zeit.*, 2, 385).—It has been previously shown that, as foretold by Maxwell, the thermal conductivity of a gas is independent of pressure. The author shows, however, that this does not hold for very low pressures, and in this case a temperature difference occurs at the surface of gas and solid. When the mean wave-length is greater than the dimensions of the containing vessel, the phenomena are very complicated. Brush's assumption of the existence of etherion is not justified, and the author considers the supposed element to be merely aqueous vapour (compare Abstr., 1899, ii, 287).

L. M. J.

Thermal Capacity and Colour Changes of Solutions of Cobalt Chloride. By M. WREWSKY (*Chem. Centr.*, 1899, i, 1202; from *J. Russ. Chem. Soc.*, 1899, 31, 164—171).—Owing to difficulties in calorimetry at high temperatures, the changes in colour were brought about by the addition of alcohol. The change from a blue to a red solution is accompanied by an increase in the difference between the thermal capacities of solution and solvent. The author considers the results support Berthelot's hydrate theory. The decrease of thermal capacity by dissolution of salts is a function of both concentration and temperature, increase of both acting in the same sense.

L. M. J.

NOTE BY ABTRACTOR.—With regard to the comparison of the heat capacities of a solution and its components, see Tammann, Abstr., 1896, ii, 289.

Thermal Capacity of Solutions of Sulphuric Acid. By EUGEN VON BIRON (*Chem. Centr.*, 1899, i, 1202—1204; from *J. Russ. Chem. Soc.*, 1899, 31, 171—203).—The author has determined the mean specific heat between 18.6 and 21.8 for solutions of sulphuric acid of the composition $H_2SO_4 \cdot nH_2O$, where n varies from 0 to 1600, the extreme values for these liquids being 0.3352 and 0.99675. The molecular heat for the monohydrate is 51.17, that calculated from its

components being 50.9, and the difference is ascribed to the heat of dissociation of the hydrate. At dilutions greater than $\text{H}_2\text{SO}_4, 100\text{H}_2\text{O}$, a linear relationship is found to exist between the equivalent electrical conductivity and the difference between the found and calculated values for the molecular heat, so that it appears probable that both owe their origin to the same cause (compare Tammann, *Abstr.*, 1896, ii, 289).
L. M. J.

Some Boiling Point Curves. II. By JOHN K. HAYWOOD (*J. Amer. Chem. Soc.*, 1899, 21, 994—1001).—A continuation of the author's previous paper (*Abstr.*, 1899, ii, 632), the mixtures examined being benzene with chloroform, carbon tetrachloride, ether, acetone, and methyl alcohol; and methyl alcohol with ethyl alcohol, carbon tetrachloride, and ether. Minima were obtained in the following cases at the temperatures and composition given: benzene with methyl alcohol, 58.3° ; 53 to 67 per cent. of benzene; methyl alcohol with carbon tetrachloride, 55.95° , about 18.4 per cent. of alcohol. The law previously suggested that chemically similar substances yield similar boiling point curves again receives support, whilst it also appears that similarity of constitution of the two mixed compounds is unfavourable to the production of a minimum even when the boiling points are close together.
L. M. J.

Liquid Mixtures of Constant Boiling Point. By GARNETT RYLAND (*Amer. Chem. J.*, 1899, 22, 384—396).—A mixture of methyl alcohol and benzene containing 38 per cent. of alcohol distils at the constant temperature $57-57.5^\circ$; similarly, a mixture of ethyl alcohol and benzene with 32 per cent. of alcohol distils unchanged at $67-68^\circ$. The composition of the mixture with constant boiling point is in both cases dependent on the pressure.

Numerous binary mixtures of organic liquids have been examined with the view of discovering mixtures of constant boiling point. Forty-five have been found to boil at a constant temperature at or below the boiling point of the more volatile constituent, two above the boiling point of the less volatile constituent, and one between the boiling points of the constituents. For these mixtures of constant boiling point, the ratio of the two constituents in the distillate is approximately that of the products of their vapour density and vapour tension at the temperature of distillation, a result in accordance with earlier researches on the subject.
J. C. P.

Melting Points in Systems of Optical Isomerides. By H. W. BAKHUIS ROOZEBOOM (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 1, 466—468).—Melting point curves for mixtures of the racemic and dextro-compounds were examined in the case of dimethyl tartrate and dimethyl diacetyltartrate. In the first case, the racemic compound melts at 89.4° and the active compound at 43.3° , and a minimum of 41.6 is reached at 3 per cent. of racemic compound; in the second case, the melting point of the racemic compound is 83.8° and that of the active compound 104.3° ; the minimum of 83.4° is reached at about 86 per cent of the racemic compound. In both cases, the form of the curve is almost horizontal at the racemic compound, and indicates

considerable dissociation. The results confirm the author's previously published theoretical views (Abstr., 1899, ii, 401). L. M. J.

Freezing Point of Mixtures of Acetic Acid and Water. By ALBERT DAHMS (*Ann. Chim. Phys.*, 1899, [vii], 18, 140—142. Compare Abstr., 1897, ii, 245; 1899, ii, 546).—Coppet's determinations of the freezing points of dilute acetic acid agree closely with the values previously obtained by the author, who has also anticipated the theoretical conclusions deduced by this investigator. G. T. M.

Freezing Point of Mixtures of Acetic Acid and Water. A Reply. By LOUIS C. DE COPPET (*Ann. Chim. Phys.*, 1899, [vii], 18, 142—144).—The author, whilst admitting that Dahms first determined the freezing point of the eutectic mixture of acetic acid and water, claims to have discovered the lower freezing point of a superfused mixture at a temperature about 2° lower than the eutectic point. The author's conclusions were originally published over 27 years ago.

Since binary liquid mixtures having two eutectic points and three freezing points are known, it is highly probable that similar mixtures having three or more eutectic points should be capable of existence. G. T. M.

Test by Freezing Point Determinations of the Dissociation Values obtained by the Conductivity Method in the case of Solutions of Potassium and Sodium Sulphates. By E. H. ARCHIBALD (*Chem. Centr.*, 1899, ii, 7, and *Chem. News*, 1899, 80, 46, *et seq.*; from *Trans. Nova Scotia Inst.*, 10, 33).—Determinations were made of the electrical conductivity of solutions of each of the compounds at various dilutions at 18° and at 0°. In the case of potassium sulphate solutions at concentrations above 0.35, the dissociation is slightly greater at 0° than at 18°. The cryoscopic depressions of the solutions were also determined by the method adopted by Loomis, with whose results also the values are in good accord. Comparison of these depressions with those calculated from the dissociation values show the agreement to be close, the differences never exceeding 4 per cent., being, however, for the sodium chloride always in the same directions. For mixtures of equal volumes of solutions containing molecular proportions of the two salts, the depression is given by the expression $D = 1.86, (1 + a_1 + a_2)N/2$, where N is the number of gram-equivalents per litre of each salt in the solutions mixed, and a_1, a_2 the dissociation [this expression appears to involve the assumption that the salts are equally dissociated, which is, however, almost the case for the salts examined], and the depressions so calculated are found to agree well with those determined experimentally. L. M. J.

Cryoscopic Behaviour of Substances with Constitutions similar to that of the Solvent. V. By FELICE GARELLI and F. CALZOLARI (*Gazzetta*, 1899, 29, ii, 357—375. Compare Abstr., 1899, ii, 732).—The cryoscopic behaviour of various substances has been studied in solvents, from which they are derived by the substitution of an amino- or a hydroxyl group for a hydrogen atom. In the following cases, abnormal molecular weights were obtained, indicating the formation of solid solutions between the solvent and the solute; *p*-hydroxy-

azobenzene and *p*-aminoazobenzene dissolved in azobenzene; *m*-nitro- and *p*-nitro-phenol and *o*-nitro-, *m*-nitro-, and *p*-nitro-aniline in nitrobenzene; 2:4-dinitroaniline in *m*-dinitrobenzene; *p*-xylydine in *p*-xylene; *p*-hydroxyacetophenone in acetophenone; triphenylcarbinol in triphenylmethane; and glycollic acid in acetic acid. With solutions of *o*-nitrophenol in nitrobenzene, 2:4-dinitrophenol in *m*-dinitrobenzene, and *p*-aminoacetophenone in acetophenone, normal molecular weights are obtained.

T. H. P.

Influence of the Solvent on the Cryoscopic Behaviour of Phenols. By KARL AUWERS [with W. BARTSCH and H. M. SMITH] (*Zeit. physikal. Chem.*, 1899, 30, 300—340).—If the abnormal cryoscopic depressions of hydroxy-compounds are due to association, then an association constant should be obtainable by a calculation similar to that used for obtaining the dissociation constant. Experiments with acetoxime, benzophenoxime, *l*-camphoroxime, benzoic acid, and *o*-bromobenzoic acid, however, show that, except in the last case, no constant value for the association constant is obtained, at least not on the assumption of double molecules. Determinations with other compounds to high concentrations further show that the molecular weight does not, in general, tend to any constant value; the greatest value of association hitherto observed is about four, whilst cryoscopic depressions of ethyl alcohol in benzene give values leading to seven times the normal molecular weight. It appears, therefore, that the abnormal depressions are not due to association, but to some mutual influence of solvent and solute, and determinations were made of the depressions of a number of hydroxy-compounds in various solvents. The following were employed as solvents, and the cryoscopic constant obtained for each is added:—Nitrobenzene, 70; *m*-dinitrobenzene, 106; *p*-nitrotoluene, 78; 2:4-dinitrotoluene, 89; 2:4:6-trinitrotoluene, 115; *p*-chloronitrobenzene, 109; *p*-dichlorobenzene, 77; *p*-chlorobromobenzene, 92; *p*-dibromobenzene, 124; benzil, 105. In all these solvents, ortho-substitution derivatives of phenol were cryoscopically normal as in benzene or naphthalene; with para-compounds, however, this is not the case, *p*-nitrophenol, methyl *p*-hydroxybenzoate, and *p*-hydroxybenzaldehyde being abnormal in the halogen compounds, but almost normal in those solvents containing a nitro-group, so that the halogen increases and the nitro-group decreases the abnormalising influence in the solvent. Other substituted phenols dissolved in *p*-dichloro-, *p*-chlorobromo-, and *p*-dibromo-benzene were then investigated, and it was found that, as in naphthalene, para-compounds are more abnormal than meta-, and the order of the groups arranged according to their influence in giving abnormal values is: aldehyde, cyanide, substituted carboxyl, nitro-groups, whilst the abnormality is greatest in dichlorobenzene, and least in dibromobenzene. The abnormal cryoscopic depressions are hence the product of two factors, one dependent on the constitution of the solute, the other on that of the solvent (compare Abstr., 1896, ii, 293; 1897, ii, 476). L. M. J.

Influence of the Medium on the Heats of Solution of Salts. By N. GALITZKI (*Chem. Centr.*, 1899, ii, 469—470; from *J. Russ. Chem. Soc.*, 31, 536—540).—The effect of increasing quantities of alcohol on

the heats of solution of potassium nitrate and potassium carbonate in water has been investigated. By the addition of alcohol to water, the heat of solution is diminished, the diminution ultimately reaching a minimum, which depends on the nature of the dissolved salt. No connection could be traced between this phenomenon and the electrical conductivity of the solutions.

J. C. P.

The Critical State. By KONRAD DIETERICI (*Ann. Phys. Chem.*, 1899, 69, 685—705).—For most substances hitherto investigated, the ratio of the actually observed critical density to the ideal density (the density which the substance would have if the law $pv = RT$ held for the critical pressure and temperature) is nearly constant, and equal to 3.75; for ethylene, nitrous oxide, nitrogen, and oxygen, the ratio differs considerably from 3.75, but this is probably due to deficient experimental methods.

In van der Waals' equation, the cohesion pressure is equal to a/v^2 , and the correction for the molecular volume is a constant b ; in these circumstances, the ratio v_0/v_k (ideal volume : critical volume) has the value 2.67. This want of correspondence between experiment and van der Waals' equation remains, even when b is regarded as a function of v .

If the equation $(p + \pi)(v - b) = RT$ be accepted, and the cohesion pressure $\pi = a/v^{5/3}$ instead of a/v^2 , the ratio v_0/v_k is equal to 3.75. This purely empirical law regarding the cohesion pressure, although it brings van der Waals' equation into agreement with the critical phenomena, is without theoretical basis.

Other theoretical considerations lead to the equation $p = RT/(v - b) \cdot e^{-A/RT}$, where A is a function of v , and represents the work to be done by a molecule against the forces of cohesion. On the supposition that $A = C/v$, the ratio v_0/v_k is equal to 3.695, a value agreeing closely with that given by experiment.

J. C. P.

Hydrolytic Dissociation in Salt Solutions. By HEINRICH LEY (*Zeit. physikal. Chem.*, 1899, 30, 193—257).—In a salt solution, besides the electrolytic dissociation, hydrolysis may occur with the formation of acid and base which further undergo electrolytic dissociation. The concentrations of the various molecular groupings present in the solution are determined by the equilibrium constants for the hydrolytic dissociation and for the electrolytic dissociation of salt, acid, base, and water. The author first investigates theoretically the necessary equations for the cases where (1) either base or acid is weak; (2) both acid and base are weak. For the determination of the hydrolysis, the method of sugar inversion was found suitable, and the author obtains the value 16.8 for the inversion constant at 100°, which is thus intermediate between the values 17.9 found by Trevor (*Abstr.*, 1893, ii, 62) and 16.0 found by Smith (*Abstr.*, 1898, ii, 155). The variation of the constant with temperature was also determined and found to be given by the expression $K_{T_1} = K_{T_0} e^{A(T_1 - T_0)/T_1 T_0}$, where A is a constant. Some salts were found to cause an irregular increase of inversion, apparently not due to hydrolysis, as, for example, lanthanum chloride. Lithium and magnesium salts have no effect, but beryllium and aluminium cause considerable inversion, and for these the hydrolytic constant was calculated at dilutions from 32 to

512. The values do not remain constant, but the author considers the agreement to be satisfactory, owing to the complicated equations and the fact that they are rigorously valid for only binary electrolytes. From the values of the dissociation, the basicity of the hydroxides may be compared, and it is thus found that beryllium hydroxide is about eleven times as strong a base as aluminium hydroxide. Salts of cerium, copper, and zinc are only very slightly hydrolysed; lead causes greater inversion, but still far less than the aluminium salts. The hydrolysis of methyl acetate was also employed for the determinations, and the values for the hydrolysis of aluminium chloride by this process agree well with those obtained by the inversion method. Conductivity determinations may also serve for the calculation of hydrolysis; the acetates of manganese, cobalt, zinc, and nickel exhibit a perfectly normal change of conductivity with dilution, and are hence not hydrolysed. With acetate of lanthanum, cerium, and lithium, this is not the case, whilst acetates of lead, beryllium, aluminium, and mercury give very abnormal results, indicating considerable hydrolysis. Where quantitative results were obtained, the values of percentage hydrolysis at $v=1024$ and 25° are: beryllium sulphate, 5 per cent.; aluminium chloride, 4.5 per cent.; lead chloride, 4.4 per cent.; uranium nitrate, 5.9 per cent.; mercuric perchlorate ($v=512$), 37 per cent. (Abstr., 1898, ii, 66).

L. M. J.

Determination of Solubility Coefficients of Liquids. By A. AIGNAN and E. DUGAS (*Compt. rend.*, 1899, 129, 643—645).—When aniline and water are mixed, there is no alteration of total volume consequent on the reciprocal solubility of the liquids, and in this case it is possible to determine the solubilities by observation of the volumes of the two layers before and after agitation, in two different experiments. The values so obtained in c.c. per cubic centimetre are: (1) aniline in water, 0.036; (2) water in aniline, 0.042. In the case of water and fermentation amyl alcohol, however, the total volume does not remain constant, and very diverse values for the solubilities, sometimes even negative, are obtained, so that in this case the author considers the case is not one of simple solubility, and the results may be due to the fact that one of the alcohols present in the fermentation amyl alcohol is capable of combining with water.

L. M. J.

Equilibrium between Manganous Salts and Ammonia. By W. HERZ (*Zeit. anorg. Chem.*, 1899, 22, 279—284).—The results previously obtained (Abstr., 1899, ii, 752) were not in harmony with the law of mass action, but it is now found that at lower concentrations the equation $K = [\text{Mn}^{++}][\text{NH}_3]^2/[\text{NH}_4]^2$ gives fairly constant values of K : in this equation, the symbols in square brackets indicate the concentrations of the respective molecules or ions. With the mean value of $K = 1.6 \times 10^{-3}$, and the dissociation constant of ammonia = 0.000023, the solubility of manganous hydroxide is calculated to be 0.6×10^{-4} , a value of the same order as that obtained by Bodländer from other considerations.

J. C. P.

Fusion of Sodium Thiosulphate. Hydrates. By FRIEDRICH WILHELM KÜSTER and A. THIEL (*Zeit. anorg. Chem.*, 1899, 21, 401—404).—Fused sodium thiosulphate might be regarded either as

a definite liquid compound, or as a reciprocal solution of the decomposition products of the crystallised salt. In the first case, excess of water or anhydrous thiosulphate in the fused hydrate would give two distinct series of solutions, the properties of which might be represented by two curves, cutting each other at the point corresponding with the composition $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$. If, on the other hand, the fused hydrate is merely a reciprocal solution of water and anhydrous salt, its properties ought to be intermediate between those of solutions with excess of water and anhydrous salt respectively. The latter behaviour has been observed in the case of the conductivity. As the number of water molecules to one molecule of anhydrous salt rises from 4.69 to 6.65, the conductivity increases proportionally, and there is no discontinuity whatever corresponding with the composition $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$.

J. C. P.

Molecular State of Ammonia and of Amines in Aqueous Solutions. By ARTHUR HANTZSCH and F. SEBALDT (*Zeit. physikal. Chem.*, 1899, 30, 258—299).—In the hope of solving this question, the author determined the partition ratio of ammonia and amines between water and other solvents. Ammonia in water and chloroform was first examined; if it exists as hydroxide, the scheme of dissociation is $\text{NH}_4\text{HO} \rightleftharpoons \text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{HO}^-$, and as ammonia is but a weak base, the latter dissociation is very slight. The calculation of the partition ratio is made on the assumption that the hydroxide itself is insoluble in chloroform, and as the concentration of the gaseous ammonia in the aqueous phase is proportional to that of the hydroxide, the total concentration may be, and is, employed instead of that of the gaseous ammonia only. The value for the partition ratio, water/chloroform at 25° , is about 25, and remains constant for varying concentrations, but it increases with fall of temperature. The values were not affected by the addition of ammonium chloride, a result the authors consider to be surprising, although, in view of the slight electrolytic dissociation of ammonium hydroxide, it might have been expected. The partition of piperidine between benzene and water and the effect of addition of piperidine hydrochloride, were next examined; the addition of sodium hydroxide was found to cause considerable decrease in the partition ratio, which was also found to decrease with increase of temperature. The partition at various temperatures was also determined for trimethylamine and triethylamine between water and toluene; acetic acid, pyridine, hydrogen cyanide, and cyanacetic acid between water and benzene; and for acetic acid, cyanacetic acid, ferric thiocyanate, and mercurous chloride between water and ether. With the amines, in every case the partition ratio decreases with rise of temperature; this was also the case in a few other systems, but in most the converse obtained. This seems to indicate the existence of hydroxides and an increase of molecular dissociation at higher temperatures, but the authors consider it more probable that hydrates, and not hydroxides, exist in the solutions. In ammonia solutions, the temperature coefficient is very small, and here especially the quantity of hydroxide must be very small.

L. M. J.

Conversion of Mixed Crystals into a Compound. By H. W. BAKHUIS ROOZEBOOM (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 74—77).—No difference is observable in the melting points of dextro-lævo-, and inactive camphoroxime, or of mixtures in any proportions; the solid mass is further perfectly homogeneous, so that the existence of mixed crystals is confirmed (Forster and Pope, *Trans.*, 1897, 71, 1049), and the melting point curve for the mixture is hence a horizontal line. The transition point to monoclinic crystals varies from 112.6° for 100 per cent. of either compound to 109.4° for the inactive mixture, and the curve is quite symmetrical, and here also mixed crystals are again formed. By cooling still more, a further change takes place, and this occurs at 103° for the inactive mixture, but the temperature is considerably reduced by excess of either component, and could not be observed at all when the percentage rose above 75. In this case, therefore, the mixed crystals become converted into a compound, and the views of Pope (*loc. cit.*) are confirmed (see *Abstr.*, 1899, ii, 401).

L. M. J.

Mixed Crystals of Mercuric Iodide and Bromide. By W. REINDERS (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 146—148).—The melting point curve of mixed crystals of mercuric iodide and bromide is continuous between the temperatures 236.5° and 255.4° , the melting points of the bromide and iodide respectively. It passes through a minimum at 216.1° , corresponding with a mixture containing 59 per cent. of mols. of the bromide, and at this temperature the crystals deposited have the same composition as the molten mixture; if the latter contains more (or less) bromide than the above-named quantity, the crystals deposited are richer (or poorer) in bromide than the mixture. Below 216° , mixed crystals in all proportions can exist.

At 127° , yellow mercuric iodide is converted into the red modification. By admixture of the bromide, this transition point is lowered and also widened out into a transition-interval determined by two limiting curves, one for the yellow, and the other for the red, crystals. The former of these runs from 127° when no bromide is present to a point on the 0° abscissa corresponding with 33 per cent. of mols. of the bromide; whilst that for the red crystals proceeds from the same starting point and cuts the 0° abscissa in a point indicating the presence of 8.6 per cent. of the bromide molecules. The transition interval was determined partly by observation of the colour change, as this made it possible to determine the composition of red crystals which at a definite temperature change completely into the yellow variety; further, solutions were found by trial, each of which deposits at a particular temperature, both red and yellow mixed crystals. These curves could not be continued below 0° , but their direction shows that, if there is a transition point for mercuric bromide, it must be at a very low temperature; at -83° , no indications of such transition could be found.

Solid mercuric bromide and iodide diffuse into one another at ordinary temperatures, and more so when heated, and the transition temperature of a finely-powdered mixture of them agrees very nearly with that of the mixed crystals of the same composition. T. H. P.

Properties of Flames. By NICOLA TECLU (*J. pr. Chem.*, 1899, [ii], 60, 396—399).—I. A stream of coal gas is allowed to issue from a platinum tube about 12 mm. in length and 2 mm. in diameter, so as to afford a flame of definite dimensions, the pressure of the gas at the point where it enters the tube being registered by means of an alcohol manometer. It is found that on heating the platinum tube by means of a flat flame bunsen burner, if the gas supply is taken directly from the main, the flame suffers a contraction of about 70 per cent., whilst the manometer registers only a small increase in pressure (about 40 mm.). If, on the other hand, the gas is supplied from a small laboratory gas-holder, the flame suffers no appreciable contraction when the tube is heated, but the manometer registers an increase in pressure nearly three times as large as in the former case (about 110 mm.).

The explanation offered is that the disturbances, set up by the sudden increase in bulk which the gas undergoes in coming into contact with the heated tube, are propagated backwards with the velocity of compression waves, and suffer reflection in the small laboratory apparatus, producing pressure in the mass of gas and thus affecting the manometer and serving to maintain the size of the flame; where the enormous technical gasometers are involved, the energy of the waves is minimised or dissipated.

II. An apparatus is described which consists of a modification of that used in the ordinary lecture experiment for demonstrating the reciprocal nature of combustion. A. L.

A Dissolver. By ARTHUR JOHN HOPKINS (*Amer. Chem. J.*, 1899, 22, 407—410).—In this apparatus, a glass tube passing through a doubly-bored indiarubber stopper, fitted to a tall glass cylinder, is connected near the bottom of the latter with one limb of a Y-tube, the lower limb of which is open, whilst the third is connected to a vertical glass tube which reaches up nearly to the stopper, and is there curved downwards. Through the second hole in the stopper passes a tube connected with a filter pump which serves to draw a current of air through the apparatus, the rate of this being regulated by a stop-cock on the tube open to the air. The crystals to be dissolved are placed at the bottom of the cylinder; the saturated solution formed there is withdrawn continuously by the suction in the Y-tube and discharged upon the less saturated solvent at the top, fresh solvent thus being brought continuously in contact with the substance to be dissolved. W. A. D.

Inorganic Chemistry.

Biological and Chemical Purification of Water. By A. TIXIER (*J. Pharm.*, 1899, [vi], 10, 297—300).—In order to avoid the liberation of free alkali which occurs when potassium permanganate or calcium permanganate is used for the purification of water, the

author uses a solution containing aluminium permanganate and barium permanganate. The solution employed has a specific gravity of 35° B., and contains 290 grams of permanganic acid per litre, and 7 per cent. of alumina. It is added to the water to be purified until a persistent pink coloration is produced; the water is allowed to remain for 24 hours, and after filtration through a carbon or other filter is fit for consumption. H. R. LE S.

New Ozone Apparatus. By NICOLA TECLU (*J. pr. Chem.*, 1899, [ii], 60, 402—403).—Several new forms of apparatus for exhibiting the phenomenon of ozone production during electric discharge are figured. A. L.

Spectrum of Chlorine. By JOSEF M. EDER and EDUARD VALENTA (*Chem. Centr.*, 1899, ii, 358).—The spectrum of chlorine was examined at pressures varying from 10 to 100 mm., a concave grating being employed. The authors confirm Ciamician's observation of the broadening of many lines and increase of brightness of the continuous spectrum by increase of pressure, but no band spectrum was obtained. Very characteristic lines were those of wave-length 4132 in the violet and 3860 in the ultra-violet, and the wave-length of many lines are given which at low pressures are seen to be doubled or trebled; a line at 3750 does not become broader by increased pressure. L. M. J.

Colour of Chlorine Solutions. By E. H. SARLES (*J. Amer. Chem. Soc.*, 1899, 21, 1038).—When chlorine is passed into ethyl alcohol, the liquid finally separates into a lower yellow layer and an upper layer having a grass-green colour. The green solution has bleaching properties which it, however, loses when uncombined chlorine is removed by a current of air or carbon dioxide. The solvent, which gives a green solution of chlorine, has not been isolated; it is either easily decomposed or very volatile, since when the liquid has been fractionated several times, the green colour is completely lost and cannot be regained by passing fresh chlorine into the liquid. J. J. S.

Theory of the Electrolytic Formation of Hypochlorite and Chlorate. By FRITZ FÖRSTER (*Zeit. anorg. Chem.*, 1899, 22, 1—32).—Investigation of the formation of hypochlorite and chlorate as a purely chemical process (Abstr., 1899, ii, 278) has prepared the way for a theory of the electrolytic preparation of these substances. A review of the work dealing with the electrolysis of alkali chlorides (compare Oettel, Abstr., 1896, ii, 517; Haber and Grinberg, Abstr., 1898, ii, 215 and 365; Wohlwill, Abstr., 1899, ii, 213) shows that the following conclusions may be regarded as established. Hypochlorite is formed chiefly by the interaction of the chlorine liberated at the anode with the alkali produced during the electrolysis or previously present: in alkaline solution, hypochlorite can be oxidised to chlorate by a primary anode process; the formation of chloric acid in the electrolysis of dilute hydrochloric acid is due to the direct oxidation of Cl ions at the anode.

A theory of the secondary electrolytic formation of chlorate is discussed, based on two suppositions; (1) that in the electrolysis of

neutral alkali chloride solutions, chlorine is continually being liberated at the anode, (2) that the hypochlorite takes part in the electrolysis, and that its ions are discharged at the anode with evolution of oxygen. The known facts regarding the influence of current density, temperature, acidity, and alkalinity, on the formation of chlorate, are largely in harmony with the theory; further experiments to determine the exact nature of the process have been made by Müller (see following abstract). J. C. P.

Formation of Hypochlorite and Chlorate in the Electrolysis of Alkali Chlorides. By ERICH MÜLLER (*Zeit. anorg. Chem.*, 1899, 22, 33—90. Compare Abstr., 1899, ii, 742).—The supposition that in the electrolysis of neutral alkali chloride solutions the formation of hypochlorite and chlorate depends on the same purely chemical process as in the non-electrolytic formation of these compounds, has several consequences. Experiment on the whole confirms these consequences, and shows that the electrolytic formation of chlorate in neutral alkali chloride solutions consists in the following processes; chlorine is discharged at the anode, and unites with the alkali from the cathode to form hypochlorite; even while the hypochlorite concentration is still small, ClO^- ions are discharged at the anode, forming hypochlorous acid, which in its turn oxidises hypochlorite and chloride to chlorate; at low temperatures, hypochlorite is to a small extent oxidised by anode oxygen.

Experiments in acid and alkaline solutions of the alkali chlorides lead to the conclusion that the electrolytic process in these does not differ essentially from that in neutral solution. The electrolytic formation of chlorate may thus be referred in general to four equations: (1) $\text{Cl}^- + 3\text{HClO} = \text{ClO}_3^- + 3\text{H}^+ + 3\text{Cl}^-$; (2) $\text{ClO}^- + 2\text{HClO} = \text{ClO}_3^- + 2\text{H}^+ + 2\text{Cl}^-$; (3) $\text{Cl}^- + 3\text{O} = \text{ClO}_3^-$; (4) $\text{ClO}^- + 2\text{O} = \text{ClO}_3^-$. In dilute hydrochloric acid, the existence of ClO^- ions is excluded, and in this case the formation of chlorate must take place according to equation (3). In other cases, the processes may be represented in varying degree; thus, when there is no appreciable evolution of oxygen, the chief processes are those indicated by equations (1) and (2); when the evolution of oxygen is considerable, as in strongly alkaline solutions, the formation of chlorate will take place chiefly according to equations (3) and (4). J. C. P.

Molecular Weights of some Elements and their Derivatives. By GIUSEPPE ODDO and E. SERRA (*Gazzetta*, 1899, 29, ii, 343—353).—The molecular weight of iodine has been determined by the boiling point method, the solvents employed being tetrachloromethane, carbon disulphide, benzene, and ethyl alcohol. The numbers obtained with the first two solvents are sensibly the same as those of Beckmann and Stock (Abstr., 1895, ii, 382). Benzene and ethyl alcohol yielded the respective values 273—279 and 265—327, Beckmann and Stock's numbers being 335—360 and 330—342; the latter results, being corrected for the volatility of iodine, give the values 233—255 and

233—241 respectively. The authors' object to this very large correction being applied, as with slow boiling, the amount of iodine volatilised is very small and scarcely sufficient to colour the vapour of the solvent.

In boiling tetrachloromethane, the sulphur molecule contains 8 atoms up to concentrations of about 3 per cent.; beyond that strength of solution, the results obtained are not concordant.

Phosphorus pentachloride has the normal molecular weight in boiling tetrachloromethane.

Solutions of iodine mono- or tri-chloride in tetrachloromethane give lower boiling points than that of the pure solvent. In the case of the trichloride, this is due to the fact that it sublimes at 70—75°. With the monochloride, dissociation takes place according to the equation $9\text{ICl} = \text{I}_2 + \text{I}_4 + 3\text{ICl}_3$, and the effect of the trichloride in lowering the boiling point is greater than that of the iodine in raising it.

T. H. P.

Action of Arsenious and Antimonious Oxides on Sulphur Monochloride. By GIUSEPPE ODDO and E. SERRA (*Gazzetta*, 1899, 29, ii, 355).—When arsenious oxide and sulphur monochloride are heated together in a reflux apparatus, they react according to the equation: $\text{As}_2\text{O}_3 + 6\text{S}_2\text{Cl}_2 = 4\text{AsCl}_3 + 3\text{SO}_2 + 9\text{S}$. The reaction is complete in about an hour, and on cooling, nearly all the sulphur formed crystallises out and the arsenic trichloride can be separated by decantation.

Analogous reactions take place when antimony or bismuth sesquioxide is substituted for the arsenic compound.

T. H. P.

Hydrates of Sulphuric Acid. By EUGEN VON BIRON (*Chem. Centr.*, 1899, ii, 467—468; from *J. Russ. Chem. Soc.*, 31, 517—522).—The author has succeeded in crystallising the hydrate $\text{H}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$, predicted by Mendeléeff. A solution of the composition $\text{H}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$, cooled with liquid air, solidifies to an amorphous mass. This mass, if rubbed at rather a higher temperature with a glass rod, becomes crystalline, the thermometer rising at the same time to -35° . The crystals thus obtained may be used to start crystallisation in a solution of the composition $\text{H}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ cooled merely to -75° with solid carbon dioxide and ether. Cooling with liquid air is detrimental to the formation of the crystals.

The freezing point of the hydrate was determined in a Beckmann's apparatus of small size, well protected by surrounding tubes, and cooled in a mixture of carbon dioxide and ether. During solidification, the thermometer remained steady for about 10 minutes, until practically no liquid was left, showing that the separation of the solid did not alter the freezing point of the remaining liquid. In solutions which deviated from the composition $\text{H}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$, the thermometer was steady for only 1—2 minutes. The freezing point of the hydrate is -38.9° ; with the same apparatus, the hydrate $\text{H}_2\text{SO}_4 \cdot 4\text{H}_2\text{O}$ solidified at -69° .

J. C. P.

Polymerisation of Inorganic Chloro-Anhydrides. I. By GIUSEPPE ODDO and E. SERRA (*Gazzetta*, 1899, 29, ii, 318—329. Compare this vol., i, 92).—Determined by the boiling point method, the

molecular weight of phosphorus oxychloride in various solvents is as follows: In tetrachloromethane, 325—362; benzene, 283—309; carbon disulphide, 214—244; chloroform, 159—164; ether, 147—157. The cryoscopic method gives a value 149—152 in benzene. The number corresponding with the formula POCl_3 is 153.5.

The molecular weight of thionyl chloride in boiling chloroform is 229—235 and in freezing benzene 108—110; the formula SOCl_2 requires 119.

Phosphorus oxybromide has a molecular weight of 287—310 in boiling tetrachloromethane and 334—352 in boiling benzene; the cryoscopic method gives a value 293—308 in benzene. The calculated value for POBr_3 is 287. Phosphorus thioclchloride gives the following molecular weights. In boiling tetrachloromethane, 209; in boiling benzene, 236—247; in freezing benzene, 158—161. The calculated number is 169.5.

For sulphur monochloride, the values obtained are, in boiling tetrachloromethane, 169—173, and in boiling benzene, 180—193; the formula S_2Cl_2 requires 135.

Chromyl chloride in boiling tetrachloromethane gives the molecular weight 225—243; in boiling benzene, 441—528; and in freezing benzene, 165—175. The formula CrO_2Cl_2 corresponds with a value 155.5.

The cryoscopic method gives for the molecular weight of sulphuryl chloride in benzene the number 131, the value for SO_2Cl_2 being 135.

T. H. P.

Properties of Solutions of Sodium Nitrite. By JOSEF JURI BOGUSKI (*Chem. Centr.*, 1899, ii, 470; from *J. Russ. Chem. Soc.*, 1899, 31, 543—551).—Sodium nitrite, prepared from the commercial article by crystallising from solutions saturated at 125° , has a yellowish tinge which disappears, however, when the salt is dried over sulphuric acid or washed with alcohol, but even then the colourless salt still forms yellowish solutions. This coloration is due to the presence of a foreign substance. The variation of the sp. gr. with the concentration of solutions of the nitrite is represented by a curve which is very nearly a straight line. The specific refractive index of solutions at 20° may be calculated from the formula $[n]_D = 1.33336 + 0.0011559 P$, where P = percentage of nitrite dissolved. The original paper contains copious data and many tables. E. W. W.

NOTE.—As to the colour of sodium nitrite and its solutions, compare Divers (*Trans.*, 1899, 75, 86), Groves (*Proc.*, 1898, 222).—EDITORS.

Preparation of Cæsium from the Carbonate. By EDMUND GRAEFE and MORITZ ECKARDT (*Zeit. anorg. Chem.*, 1899, 22, 158—160).—A repetition of Winkler's experiments (*Abstr.*, 1890, 331) on the reduction of alkaline carbonates proves Beketoff's assertion that the reduction to metal takes place more easily as the atomic weight increases. The preparation of cæsium is effected at a lower temperature than that of rubidium or potassium. A mixture in the proportion $\text{R}_2\text{CO}_3 : 3\text{Mg}$ is heated in an iron tube, free from rust, in a slow current of dry hydrogen and the metal, which distils

collected under petroleum; a theoretical yield is obtained. Metallic caesium is silver-white with a yellow tinge, retains its lustre under petroleum, oxidises with development of heat on exposure to the air, then melts and explodes, swims on water, and burns with a reddish-violet flame with liberation of hydrogen. E. C. R.

Calcium and its Compounds. By HENRI MOISSAN (*Ann. Chim. Phys.*, 1899, [vii], 18, 289—343).—A detailed account of work already published (compare Abstr., 1894, i, 313; 1898, ii, 116, 161, 578; 1899, ii, 25, 152, 153, 155, 219, 241, and 418). G. T. M.

Setting of Gypsum. By KARL ZULKOWSKI (*Chem. Centr.*, 1899, ii, 602—603; from *Chem. Ind.*, 22, 349—352).—The setting of the ordinary roasted gypsum is due to the formation of the calcium salt, $\text{S}(\text{OH})_4 \cdot \text{O}_2\text{Ca}$, of hexabasic sulphuric acid by the action of water (2 mols.). Gypsum which has been roasted at a moderate red heat is also capable of taking up water, but on account of its greater density it only combines with 1 mol. of water, forming the calcium salt, $\text{SO}(\text{OH})_2 \cdot \text{O}_2\text{Ca}$, of tetrabasic sulphuric acid. The water has a twofold action, first dissolving the more soluble calcium compound, and then combining with it to form a less soluble compound which separates in a crystalline form and sets to a compact mass. E. W. W.

Preparation and Properties of Crystallised Barium and Strontium Phosphides. By A. JABOIN (*Compt. rend.*, 1899, 129, 762—765).—Crystallised strontium phosphide is obtained by heating a mixture of lampblack and strontium phosphate for 3 or 4 minutes in an electric furnace with a current of 45 volts and 950 ampères, and the barium compound is obtained in a similar way. *Strontium phosphide*, Sr_3P_2 , burns in fluorine at the ordinary temperature, in chlorine at about 30° , in bromine at 170 — 175° , in iodine at a red heat, in oxygen above 300° , and in sulphur vapour at a higher temperature. It is decomposed by carbon at a high temperature, but not by sodium at a red heat; by dilute acids and gaseous hydracids, but not by concentrated acids, nor by hydrogen sulphide or ammonia, nor by organic solvents. It alters rapidly in moist air, is decomposed by water with liberation of hydrogen phosphide, and is violently attacked by oxidising agents. Its sp. gr. is 2.68 and it melts only in the electric furnace. *Barium phosphide*, Ba_3P_2 , has similar properties, but is not so readily attacked; it burns in chlorine at 90° and in bromine at 260 — 300° . Its sp. gr. is 3.183. C. H. B.

Formation of Oceanic Salt Deposits, Particularly of the Stassfurt Beds. XIV. Influence of Pressure on the Formation of Tachyhydrite. By JACOBUS H. VAN'T HOFF and H. M. DAWSON (*Chem. Centr.*, 1899, ii, 401—402; from *Sitzungsber. Akad. Wiss. Berlin*, 1899, 557—562. Compare Abstr., 1899, 759).—The effect of increase of temperature and pressure on the evaporation of sea-water is to cause the separation of new compounds, for when the change of the solubilities of the various compounds affected by the alteration of conditions exceeds certain limits, supersaturation with new compounds is rendered possible. Increase of temperature and pressure results in the formation of kieserite, löweite, kainite, and langbeinite, none of

these compounds being formed when sea water is evaporated at 25° under the ordinary pressure. The salt basins of Besançon have a temperature of 62° at a depth of 1.35 metres, and reckoning on this basis the variations of temperature and pressure in the case of the Stassfurt beds which have a maximum depth of 1500 metres amount to 40 and 180 atmospheres respectively.

The effect of changes of temperature and pressure has been investigated in the case of the formation of tachyhydrite ($\text{MgCl}_2 \cdot \text{Ca} \cdot 12\text{H}_2\text{O}$), which easily separates from mixed solutions of the hexahydrates of magnesium and calcium chlorides at 22°. Experiments with the manocryometer and Beckmann's thermometer show that an extra pressure of one atmosphere only raises the temperature of the formation of tachyhydrite by 0.017°. This effect is comparable with that of pressure on melting points; it lies between the raising of the melting point of ice by 0.0073° and that of paraffin by 0.035° caused by a pressure of one atmosphere. Hence, since an increase of pressure of 180 atmospheres would only raise the temperature of formation by 3°, the effect of increase of temperature must be of much greater importance.

E. W. W.

Solution of Copper in Gelatin Solutions. By ALEXANDER P. LIDOFF (*Chem. Centr.*, 1899, ii, 471; from *J. Russ. Chem. Soc.*, 1899, 31, 571—572).—From the results of experiments on the action of copper salts on alkaline solutions of albumin, it appears that the biuret reaction really depends on the dissolution of copper, the copper salt being reduced to soluble colloidal copper. An alkaline solution of gelatin in which copper gauze was placed had acquired a violet coloration after remaining a day, and after 48 days 3.54 per cent. of the copper was found to have been dissolved.

E. W. W.

Manganese Trichloride and Tetrachloride. By RICHARD JOS. MEYER and HANS BEST (*Zeit. anorg. Chem.*, 1899, 22, 169—191).—The dark green solution of oxides of manganese in hydrochloric acid contains manganese trichloride. Each of the oxides, Mn_2O_3 , Mn_3O_4 , or MnO_2 , when dissolved in absolute alcohol or ether saturated with hydrogen chloride, yields a solution of manganese trichloride which is decomposed by water and also by evaporation in a vacuum over sulphuric acid, and consequently the trichloride cannot be isolated. It, however, yields very characteristic double salts with pyridine and quinoline hydrochlorides which crystallise in lustrous needles.

The action of hydrogen bromide on the oxides of manganese results in the formation of the dibromide which yields a crystalline double salt with pyridine hydrobromide.

When potassium permanganate is boiled with acetic acid, carbon dioxide is evolved and a brown solution obtained, which on cooling deposits the salt, $3\text{MnO}_2 \cdot \text{Mn}_2(\text{C}_2\text{H}_3\text{O}_2)_6 + 2\text{C}_2\text{H}_4\text{O}_2$, and if a small quantity of water is added to the mother liquor, Christensen's triacetate, $\text{Mn}_2(\text{C}_2\text{H}_3\text{O}_2)_6 + 4\text{H}_2\text{O}$, crystallises out. The solution obtained by reducing potassium permanganate with acetic acid with the addition of 1 mol. of potassium acetate, when saturated with hydrogen chloride yields the double salt $\text{MnCl}_2 \cdot 2\text{KCl}$ (Rice, *Trans.*, 1898, 75, 258). If, however, the solution is only partially saturated with

hydrogen chloride, the salt $\text{MnCl}_4 \cdot \text{MnCl}_2 \cdot 5\text{KCl}$ is obtained. When the acetic acid solution of potassium permanganate, without the addition of potassium acetate, is saturated with hydrogen chloride, a small quantity of the salt $\text{MnCl}_4 \cdot 2\text{KCl}$ is obtained as a black, crystalline precipitate, and the mother liquors contain large quantities of manganese trichloride. The corresponding ammonium salts could not be isolated, although the reaction proceeds apparently in a similar manner. Cæsium permanganate, under similar conditions, yields the salt $\text{MnCl}_4 \cdot 2\text{CsCl}$. Thallium permanganate does not yield a double salt.

The double sulphate, $\text{Mn}_2(\text{SO}_4)_3 \cdot \text{K}_2\text{SO}_4$, is precipitated quantitatively by adding sulphuric acid to the solution of potassium permanganate in acetic acid.

The higher chlorides of iron, cobalt, and nickel are not obtained by the above method. Lead dioxide, when dissolved in cold alcohol saturated with hydrogen chloride, is converted into the tetrachloride, which yields crystalline double salts with pyridine, di- and tri-methylamine hydrochloride, and tetramethylammonium chloride.

Thallium permanganate, TlMnO_4 , forms large, nearly black prisms.

E. C. R.

Atomic Weight of Cobalt. III. Analysis of Cobaltous Chloride and Cobaltous Oxide. By THEODORE W. RICHARDS and GREGORY P. BAXTER (*Zeit. anorg. Chem.*, 1899, 22, 221—234. Compare Abstr., 1898, ii, 377, and 1899, ii, 753).—The authors have determined the weight of the cobalt obtained from a known weight of cobaltous chloride by reducing it in a current of hydrogen. The methods employed are essentially the same as those previously described. The mean of the two experiments gives for the atomic weight $\text{Co} = 59.045$. The cobaltous chloride was prepared by decomposing purpureo-cobalt chloride at 200° and eliminating the remaining ammonium chloride by heating in a current of nitrogen and hydrogen chloride. The cobaltous chloride was found to contain small quantities of ammonium chloride, alkali salts, and silica.

Cobaltous oxide is prepared by precipitating a solution of pure cobalt in nitric acid with ammonia, and after heating the precipitate over a spirit burner, decomposing the resulting black oxide at a red heat in a vacuum. The reduction of the cobaltous oxide by means of hydrogen gave for the atomic weight $\text{Co} = 58.954$ (mean of three experiments). An examination of the cobaltous oxide shows that it contains a small quantity of a higher oxide; also, by heating the oxide in a vacuum at 800° , a partial reduction takes place into metal and oxygen, and since a perfectly constant oxide could not be obtained, the authors have abandoned the experiments.

The results of all the experiments show that the atomic weight of cobalt lies between 58.93 and 59.06 and the most probable value is $\text{Co} = 58.995$ when $\text{O} = 16$.

E. C. R.

Occlusion of Hydrogen by Cobalt and other Metals. By GREGORY P. BAXTER (*Amer. Chem. J.*, 1899, 22, 351—364).—Although cobalt in the form of ingots, which therefore presents a minimum amount of surface, is known to occlude practically no hydrogen, it is

found that when reduced from the oxide, and therefore in a very finely divided condition, it occludes relatively large amounts of this gas. Electrolytic foil, which although somewhat porous lies between the two modifications in relative surface, falls between them also in its occluding power. The volume of occluded hydrogen varies, in the case of metal reduced from the oxide, with its purity and the temperature of reduction; it is remarkable that the metal reduced from cobalt bromide occludes practically no hydrogen; this appears to be due to its being deposited in a more compact form than that reduced from the oxide, as the presence of sodium bromide has no perceptible effect on the amount of occluded gas. Since the occlusion of hydrogen progresses very slowly at the ordinary temperature and is practically negligible at the temperature of reduction ($400-500^{\circ}$), it must be a maximum at some intermediate temperature; the time during which the metal is in contact with hydrogen determines largely the amount of gas taken up. Although practically none of the hydrogen occluded is given off in a vacuum at the ordinary temperature, yet on heating in a vacuum nearly the whole is evolved.

The occlusion of hydrogen by nickel appears to be governed by similar conditions to those dealt with in the case of cobalt; with pure copper and silver, the occlusion is practically *nil*. W. A. D.

Chromyl Chloride, Chlorochromic Acid, and Aminochromic Acid. By RICHARD JOS. MEYER and HANS BEST (*Zeit. anorg. Chem.*, 1899, 22, 192—199).—Chromyl chloride is obtained by the action of hydrogen chloride on a solution of chromic acid in acetic acid, but cannot be separated from the acetic acid solution. When pyridine, dissolved in acetic acid, is added to the solution, chlorine is evolved, and the *pyridine* salt of hexachlorotrichromyl chloride, $\text{Cr}_2\text{O}_3\text{Cl}_6 \cdot 3\text{PyHCl}$, is obtained, which crystallises in brownish-gold leaflets. The same salt is also obtained by adding pyridine hydrochloride to a solution of pure chromyl chloride in acetic acid.

Pyridine and quinoline, when added to a solution of potassium chlorochromate in acetic acid, yield pyridine and quinoline chlorochromates respectively, which separate in yellowish-red crystals, are stable, and can be recrystallised from dilute hydrochloric acid.

No evidence of the formation of aminochromic acid was obtained by the action of ammonia on a solution of potassium chlorochromate in dry acetone. E. C. R.

Recovery of Chromic Acid from Chromium Residues. By FRIEDRICH REGELSBERGER (*Zeit. angew. Chem.*, 1899, 1123—1128).—Various methods have been suggested for recovering chromic acid (compare Häussermann, *Dingl.*, 268, 163; Lorenz, *Abstr.*, 1896, ii, 265; Heibling, French Pat. 275274; Fitzgerald, Eng. Pat. 1896, 5542; Dercum, Eng. Pat. 1898, 3801; Meister, Lucius, and Brünig, German Pat. 103860). Two different electrolytic methods are described in the paper. The one consists in oxidation in alkaline solution: a current is passed through a saturated solution of an alkaline chloride containing an amount of chromic oxide or chromium salt equivalent to the current in unit time. When potassium chloride is employed, potassium dichromate crystallises from the hot solution

after some time, and chlorine is liberated. The metal vessel in which the electrolysis was conducted served as the cathode, and platinum gauze as the anode, and, to ensure complete admixture, air was blown through. The method may be of practical use when the chromium liquors contain considerable amounts of organic matter, or when solid chromium residues have to be dealt with.

The second method consists in the use of lead anodes in acid solution, either with or without a diaphragm; the lead is first converted into peroxide, which then oxidises the chromium compounds. The electrolysis proceeds best in hot solution, and almost any metal may be employed as cathode. Iron salts must not be present in the liquid.

J. J. S.

Preparation of Molybdenum and Uranium with the Aid of Liquid Air. By ALFRED STAIVENHAGEN (*Ber.*, 1899, 32, 3065. Compare next abstract but one).—The yield of molybdenum from a mixture of molybdic acid, aluminium, and liquid air is poor, owing to the volatility of molybdic oxide. A mixture of uranic acid and aluminium explodes with great difficulty, but when liquid air is added, the reaction is very violent, and a thoroughly fused uranium regulus is obtained.

G. T. M.

Molybdenum Dioxide. By MARCEL GUICHARD (*Compt. rend.*, 1899, 129, 722—725).—Various oxides of molybdenum, intermediate in composition between MoO_2 and MoO_3 , have been described by former observers as being produced by heating molybdenum trioxide with ammonium molybdate and by the electrolysis of fused molybdenum trioxide. Both these reactions have been studied by the author, who finds that the sole product, after excess of molybdenum trioxide has been removed by successive washing with soda and hydrochloric acid, is in each case molybdenum dioxide, which was obtained in a pure, crystalline state.

N. L.

Preparation of Tungsten with the Aid of Liquid Air. By ALFRED STAIVENHAGEN (*Ber.*, 1899, 32, 3064—3065).—The addition of liquid air to the mixture of aluminium and tungstic acid employed in the preparation of tungsten (*Abstr.*, 1899, ii, 489), produces, on explosion, so great a rise of temperature that a completely fused regulus of tungsten is obtained which contains only traces of aluminium. The author was unable to obtain the element by Hallepeau's electrolytic method (*Abstr.*, 1899, ii, 158). When molten lithium paratungstate is electrolysed with a current of 3.5 ampères and an E.M.F. of 12 volts, bluish-black crystals of lithium-tungsten bronze are produced.

G. T. M.

Tungsten. By EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1899, 21, 1007—1008).—An introductory paper, referring to those treated in the following abstracts and in this vol., i, 76, 89.

J. J. S.

Atomic Weight of Tungsten. By EDGAR F. SMITH and WILLETT L. HARDIN (*J. Amer. Chem. Soc.*, 1899, 21, 1017—1027. Compare *Abstr.*, 1898, ii, 336).—Recent experiments prove that practically no hydrogen is occluded when metallic tungsten is allowed to cool in an atmosphere of this gas (compare Waddell, *Abstr.*, 1887, 112; Derenbach,

Inaug. Diss. Würzburg, 1892). It has been proved that tungsten trioxide exists in two varieties, crystalline and amorphous. These differ in specific gravity and also in their solubility in sulphur monochloride; they may be converted into one another. If the insoluble oxide is converted into ammonium tungstate and then ignited, the oxide which is formed dissolves in sulphur chloride at 145° , and when the metal obtained from the oxychloride is heated in a current of oxygen, the oxide formed is insoluble in sulphur chloride at 145° .

The authors conclude that, so far, there is no trustworthy method for the determination of the atomic weight of tungsten. The methods they have employed are (1) heating pure tungsten in air or in pure oxygen; (2) precipitating metallic silver from silver nitrate solution by the aid of metallic tungsten (compare Smith, *Abstr.*, 1893, ii, 170); (3) estimating the water of crystallisation in barium metatungstate (compare Scheibler, *J. prakt. Chem.*, 1861, 83, 324). In no case were concordant results obtained.

J. J. S.

Action of Sulphur Monochloride on Tungsten Trioxide. By EDGAR F. SMITH and HERMANN FLECK (*J. Amer. Chem. Soc.*, 1899, 21, 1008—1013).—When tungsten trioxide, the dioxide, or the mineral wolframite or scheelite is heated with sulphur monochloride, a red solution of tungsten oxychloride, $WOCl_4$, is obtained, together with a small amount of a brown, insoluble substance. The trioxide obtained by heating ammonium tungstate, or the trioxide which has been heated for some time in the air, is not completely acted on by sulphur chloride, whereas the trioxide obtained by heating the oxychloride is practically all dissolved by it. This difference is not due to the presence of a nitride or oxynitride. Tungsten itself is not acted on by pure sulphur monochloride, but if free chlorine is present, tungsten hexachloride is formed.

J. J. S.

Rays Emitted by Uranium and Thorium Compounds. By SKŁODOWSKA CURIE (*Compt. rend.*, 1898, 126, 1101—1103).—The electrical conductivity of air, when induced by the Becquerel rays emitted by uranium compounds, varies directly with the amount of this element present in the active substance. All uranium compounds are active, and the metal itself more so than any of its derivatives, except pitchblende and native chalcocite (copper uranylphosphate); the latter substance, however, when prepared artificially, is less active than the metal; these results seem to indicate that the two minerals contain an element far more active than uranium. Thorium compounds are very active, the action of thoria being more pronounced than that of metallic uranium; cerium, niobium, and tantalum compounds are slightly active. Yellow phosphorus is extremely active, but its action is probably of a nature different from that of uranium and thorium; in the allotropic form and in the phosphates, it is quite inert; the compounds of all other elements do not appreciably influence the electrical conductivity of air. The effects produced by the rays vary directly with the thickness of the layer of active substance; the rays traverse thin sheets of glass, ebonite, paper, and the metals. The rays emitted by thoria are more penetrating than those from uranium, and the penetrative power is augmented by increasing the layer of the oxide.

Distinct photographic impressions are obtained in the case of uranium, uranous oxide, pitchblende, chalcocite, and thorium, but those produced by thorium sulphate and potassium fluoroxytantalate are very faint. When uranium and thorium compounds are subjected to the influence of Röntgen rays, they emit secondary rays, which produce a more intense effect than those emitted by lead under similar conditions.

G. T. M.

New Radio-active Substance contained in Pitchblende. By P. CURIE and SKŁODOWSKA CURIE (*Compt. rend.*, 1898, 127, 175—178. Compare preceding abstract).—A specimen of pitchblende, having $2\frac{1}{2}$ times the emissive power of uranium, was examined chemically with a view of isolating the radio-active principle which produces the abnormal activity. The mineral was dissolved in acids and treated with hydrogen sulphide, the thorium and uranium remain in solution, whilst the active substance is precipitated with the sulphides insoluble in ammonium sulphide; after separating these in the usual manner, it is found that the substance in question remains with the bismuth.

When the sulphides are treated with nitric acid, the less active portion dissolves more readily; and when the solution of the nitrates is diluted with water the more active portion is first precipitated; the progress of the separation is controlled by determining the electrical conductivity of air induced by the various fractions. An extremely active product can be isolated from pitchblende by sublimation, and when the sulphides of bismuth and the active substance are heated in a vacuum at 700° , a sublimate is obtained, the activity of which is 400 times that of uranium. It is believed that the extremely active substance obtained from pitchblende contains an unknown metal to which the name *polonium* is given. Spectroscopic examination of the substance, however, has not revealed the existence of any characteristic lines indicating the presence of a new element.

G. T. M.

An extremely Radio-active Substance contained in Pitchblende. By P. CURIE, SKŁODOWSKA CURIE, and GUSTAVE BÉMONT (*Compt. rend.*, 1898, 127, 1215—1217. Compare preceding abstracts).—In the course of their researches on radio-active substances, the authors have obtained a product having all the properties of barium chloride, and, in fact, consisting mainly of this compound, but differing from the ordinary chloride in being extremely active. By repeated fractional precipitation of the active chloride from its aqueous solution by alcohol, a product is obtained which is 900 times more active than uranium. Ordinary barium salts are never radio-active, and, moreover, spectroscopic examination of the active substance has revealed the presence of a well-defined line not belonging to any known element (compare following abstract); the distinctness of the line increases with the radio-activity of the fraction under inspection. For these reasons, it is supposed that the active barium chloride contains another radio-active element for which the name *radium* is proposed. The atomic weight of barium in the active salt is not markedly different from that of the element in its inactive compounds.

The compounds of uranium, thorium, polonium, and radium all give photographic effects on sensitive plates, and in this respect

polonium and radium are far more active than the other two; the rays emitted by the new elements render barium platincyanide fluorescent, but the effect is less marked than with Röntgen rays.

G. T. M.

Spectrum of a Radio-active Substance [in Barium Chloride]. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1898, 127, 1218. Compare preceding abstract).—The spectrum of the radio-active barium chloride, together with distinct indications of barium and faint lines due to lead, calcium, and platinum (from electrodes), contains a well-defined line of wave-length 3814·8 (Rowland's scale) which appears between the platinum lines 3819·9 and 3801·5; this line has not been noticed in the spectra of any of the known elements.

G. T. M.

Spectrum of Radium. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1899, 129, 716—717).—The following lines characteristic of radium were obtained from the photographed spectrum of a specimen of barium chloride containing that element. The numbers 1 to 16 indicate the order of intensity. λ , 4826·3, (10); 4726·9, (5); 4699·8, (3); 4692·1, (7); 4683·0, (14); 4641·9, (4); 4627·4, (4), the centre of a nebulous band; 4600·3, (3); 4533·5, (9); 4458·0, (3), the centre of a nebulous band; 4436·1, (8); 4364·2, (3); 4340·6, (12); 3814·7, (16); 3649·6, (12). A number of feeble lines of uncertain origin were also observed.

N. L.

Atomic Weight of the Metal in Radio-active Barium Chloride. By SKŁODOWSKA CURIE (*Compt. rend.*, 1899, 129, 760—762).—Radio-active barium chloride obtained from a large quantity of uranium residues was fractionally crystallised, and the radio-active constituent was found to accumulate in the less soluble portions; when the latter were dissolved in water and fractionally precipitated by alcohol, the active substance was concentrated in the first precipitates. The atomic weight of the radio-active barium increases with the intensity of the radiation; with an intensity 3000 times as great as that of uranium, the atomic weight is 140·0; 4700 times as great, 140·9, and 7500 as great, 145·8. The radio-activity of the crystallised or precipitated compounds increases in a marked manner for several weeks after their preparation, but eventually attains a limiting value which may be five or six times as great as the value immediately after their preparation (compare Giesel, *Ann. Phys. Chem.*, 1899, [ii], 69, 91).

C. H. B.

Enantiotropy of Tin. By ERNST COHEN and C. VAN EYCK (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 77).—It is well known that at low temperatures tin becomes converted into a grey powder, but the change has been but little investigated, and various reasons have been assigned for it. The authors find that at -83° the change occurred in about 24 hours, and the reverse transition could not be observed below 30° . At temperatures between these limits, the velocity of the change becomes so small as to be incapable of measurement. By the addition of a few drops of a 10 per cent. solution of ammonium stannic chloride, however, the reaction is considerably accelerated, and dilatometric observations employing this liquid for measurement purposes indicated

a temperature of between 10° and 20° for the transition. Determinations of the E.M.F. of the cell: white tin/10 per cent ammonium stannic chloride/grey tin, gave 20° for the temperature of transition. It hence appears that all tin exists, save in exceptionally warm weather, in the metastable condition. L. M. J.

Thio- and Seleno-antimonites. By ISIDORE POUGET (*Ann. Chim. Phys.*, 1899, [vii], 18, 508—571. Compare Abstr., 1897, ii, 499).—The following salts are described for the first time. *Lithium orthothioantimonite*, $\text{Li}_3\text{SbS}_3 + 3\text{H}_2\text{O}$, forms white, deliquescent crystals; the *para-salt* $\text{Li}_4\text{Sb}_4\text{S}_7 + 3\text{H}_2\text{O}$, is a dark red, gelatinous precipitate which has not been obtained crystalline.

Ammonium orthothioantimonite, $(\text{NH}_4)_3\text{SbS}_3$, is precipitated as a white, crystalline powder on adding alcohol to the mother liquor from the meta-salt; it readily decomposes and is only stable in the presence of ammonium sulphide.

Barium metathioantimonite, $\text{Ba}(\text{SbS}_2)_2 + 4\frac{1}{2}\text{H}_2\text{O}$, is an amorphous, brown precipitate.

Triargentic thioantimonite, Ag_3SbS_3 , is obtained as an amorphous, black precipitate by the addition of silver nitrate to a dilute solution of potassium orthothioantimonite; the double salt, Ag_2KSbS_3 , is a yellow, crystalline precipitate produced by the action of silver nitrate on concentrated solutions of the potassium ortho- or pyro-salt (Sommerlad, Abstr., 1897, ii, 500). A series of double salts of the formula RAg_2SbS_3 is obtained from sodium, lithium, and ammonium thioantimonites; these compounds are all decomposed by water into triargentic thioantimonite and the corresponding alkali salt.

Zinc orthothioantimonite, $\text{Zn}_3(\text{SbS}_3)_2$, forms a yellow, crystalline precipitate, produced by the action of zinc salts on dilute solutions of potassium thioantimonite; the *double salt*, ZnKSbS_3 , is obtained when concentrated solutions are employed.

The corresponding *manganese* salts, $\text{Mn}_3(\text{SbS}_3)_2$ and MnKSbS_3 , are produced in a similar manner; they form pale red, crystalline precipitates.

The *lead* salts, $\text{Pb}_3(\text{SbS}_3)_2$ and PbKSbS_3 , are brown precipitates. The reaction between potassium orthothioantimonite and cadmium, nickel, cobalt, and ferrous salts, follows the same course as in the preceding examples, but the products are very unstable.

Cuprous potassium orthothioantimonite, $\text{Cu}_2\text{KSbS}_3 + 3\text{H}_2\text{O}$, is a yellow, crystalline precipitate obtained by treating a cupric salt with excess of a concentrated solution of potassium orthothioantimonite; *cuprous orthoantimonite*, Cu_3SbS_3 , is produced by treating the preceding double salt with water; it is a red, crystalline precipitate. A black precipitate of *cupric thioantimonite* is formed when cupric salts are treated with a dilute solution of potassium orthothioantimonite; if, however, the latter reagent is in excess, it gradually reduces the cupric salt and the precipitate then consists of a mixture of this compound with the cuprous salt.

When mercurous salts are added to solutions of the alkali orthothioantimonites, the yellow precipitate at first produced is rapidly converted into a black deposit of mercury; mercurous salts react in a

similar manner. Gold chloride, when mixed with a concentrated solution of thioantimonite, produces a brown precipitate; this redissolves on agitation, and the solution, when warmed, deposits metallic gold.

Potassium orthoselenoantimonite, K_3SbSe_3 , is obtained in the form of orange crystals on evaporating a solution of antimony selenide in potassium selenide in a current of hydrogen; the salt is extremely unstable and its solution rapidly deposits selenium. The *para*-salt $K_2Sb_4Se_7 + 3H_2O$, separates as a gelatinous, brown precipitate on cooling a saturated solution of its generators.

Sodium orthoselenoantimonite, $Na_3SbSe_3 + 9H_2O$, crystallises in yellow needles from a solution of antimony selenide in sodium selenide; it is even more oxidisable than its potassium analogue, and its solution deposits red, tetrahedral crystals of sodium selenoantimonate, $Na_3SbSe_4 + 9H_2O$.

By the joint action of selenium and antimony dissolved in potassium sulphide, the mixed *salt*, $K_{10}Sb_5S_5Se_6 + 4H_2O$, is produced; it separates from the concentrated solution in small, yellow crystals. When a solution of sodium selenide is employed as the medium, two compounds are produced; the less soluble is a complex *salt* having the composition $Na_3SbS_{1.5}Se_{2.5} + 9H_2O$, which corresponds with the thioantimonate, $Na_3SbS_4 + 9H_2O$; the more soluble *salt*, $Na_3SbS_{1.5}Se_{1.5} + 9H_2O$, forms yellow needles and is analogous to the orthoantimonite, $Na_3SbS_3 + 9H_2O$.

Tellurium derivatives, analogous to the preceding compounds, could not be prepared; antimony telluride does not dissolve in a hot solution of potassium telluride, K_2Te , or potassium hydrotelluride, $KHTe$, and tellurium itself is insoluble in alkali sulphides. G. T. M.

Derivatives and Atomic Weight of Palladium. By WILLETT LEPLÉY HARDIN (*J. Amer. Chem. Soc.*, 1899, 21, 943—955. Compare Rosenheim and Maass, *Abstr.*, 1899, i, 163).—Palladobis-phenylammonium chloride, $Pd(NH_2PhCl)_2$, is obtained as a voluminous yellow precipitate when a slight excess of aniline is added to a hydrochloric acid solution of palladious chloride, it is insoluble in hydrochloric acid, but dissolves in ammonium hydroxide solution; the *bromide*, $Pd(NH_2PhBr)_2$, resembles the chloride. *Palladodiquinolinium chloride*, $Pd(C_9NH_7Cl)_2$, the corresponding *bromide* and *palladodipiperidium chloride*, $Pd(C_5NH_{11}Cl)_2$, all form pale yellow precipitates. They are not acted on by hydrogen at the ordinary temperature, but are readily reduced to metallic palladium when heated in hydrogen and the product allowed to cool in a current of air. A compound, $PdCl_2 \cdot 2NH_2Et \cdot 2HCl$, crystallising in brownish-red scales has also been prepared.

The atomic weight of palladium has been determined by various authorities (Berzelius, 1828; Keiser, *Abstr.*, 1890, 17; Keller and Smith, *ibid.*, 1893, ii, 73; Bailey and Lamb, *Trans.*, 1892, 61, 745; Joly and Leidie, *Abstr.*, 1893, ii, 284; Keiser and Breed, *ibid.*, 1894, ii, 141) and has now been determined by analysing diphenylpalladodiammonium chloride (seven experiments) and bromide (five experiments), and also ammonium palladium bromide (four experi-

ments), all of which were prepared from carefully purified palla. The mean result obtained was 107.014 ($O=16$), which is some above that given by other authorities. J. J

Mineralogical Chemistry.

Libollite. By JACINTO PEDRO GOMES (*Comm. Direc. Tra Geol. Portugal*, 1898, 3, 244—250, 290—291).—Libollite is the given to an asphalt resembling albertite which is found near Li province of Angola, in Portuguese West Africa. Analysis gave

C.	H.	O.	N.	Ash.	Sp. g
74.74	7.83	8.80	1.71	6.92	1.1
					L. J

Limonite Pseudomorphs from Dutch Guiana. By ROBERT W. RAYMOND (*Trans. Amer. Inst. Mining Eng.*, 1899, 28, 235—).—The auriferous alluvial deposits in the Saramacca district of I Guiana contain cubes of limonite pseudomorphous after pyrites; these are sometimes hollow and are partly filled with a reddish po. Analyses by A. R. Ledoux of the outer light red crust gave I, and the interior darker red material gave II.

	Fe ₂ O ₃	Al ₂ O ₃	SiO ₂	H ₂ O.	Total
I.	42.90	17.70	30.44	5.90	96.94
II.	87.94	0.90	2.34	7.50	98.68

A small amount of gold is present in II, but not in I. L. J.

Chromite from Newfoundland. By GEORGE W. MAY (*Trans. Amer. Inst. Mining Eng.*, 1898, 27, 283—288).—Deposits of chromite are found in serpentine at Port-au-Port Bay, on the coast of Newfoundland. Analysis by E. Waller of a selected sample of the ore gave:

Cr ₂ O ₃	FeO.	MgO.	Al ₂ O ₃	SiO ₂	Total.
49.23	17.21	18.66	7.50	6.51	99.11

Also traces of calcium, vanadium, copper and manganese.

L. J.

Occurrence of Nickel in Silesia. By O. H. ASCHERMANN (*Kryst. Min.*, 1899, 32, 106; from *Inaug. Diss. Breslau*, 1897, 43).—Nickel occurs at Frankenstein, Silesia, as silicates in a red deposit, a product of serpentine (Abstr., 1895, ii, 514). The unaltered serpentine contains, according to two determinations, 0.0866 and 0.148 per cent. of nickel. L. J.

Leverrierite. By PIERRE TERMIER (*Bull. Soc. franç. Min.*, 1902, 27—31).—Previous analyses of this mineral are unsatisfactory owing to the presence of admixed quartz and clay. A new analysis made on more pure material from Rochebelle, Gard, gave the following results. Sp. gr. 2.598.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO.	CaO.	K ₂ O.	Loss on ignition.	Total.
49.90	37.02	3.65	0.30	trace	1.13	8.65	100.65

The material analysed was dried at 110°. The loss on ignition is mainly water with a very little carbonaceous matter. The colourless crystals become white at 500°. This analysis agrees approximately with the formula $(\text{H}, \text{K})_2\text{O} \cdot (\text{Al}, \text{Fe})_2\text{O}_3 \cdot 2\text{SiO}_2$. The mineral therefore differs from kaolinite ($2\text{H}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$), and resembles muscovite, but has water largely replacing potash.

Optical determinations are also given.

L. J. S.

Minerals of Japan. By KOTORA JIMBŌ (*J. Sci. Coll. Imp. Univ. Tokyo*, 1899, 11, 213—281).—A description, dealing mainly with occurrences, is given of 128 mineral species found in Japan. Some of the information has been previously published in Japanese journals. Analyses are given of the following.

Topaz. Good crystals of topaz are found at Takayama, &c., in province Mino, and at Tanokamiyama in province Ōmi. The crystals from Ōmi are usually brownish and occur with flesh-red felspar; analyses by Takayama gave the results under I and II.

Olivine in brown crystals occurs with crystals of augite in a basalt at Nishinotake in Hizen; analysis III by Kondō.

	SiO ₂	Al ₂ O ₃	MgO.	FeO.	CaO.	F.	Total.
I.	31.30	56.72	—	—	—	18.36	106.38
II.	31.95	56.59	—	—	—	18.01	106.55
III.	38.74	—	43.53	16.60	trace	—	98.87

Axinite occurs in the copper mine at Ōkuradani, Obira, province Bungo, associated with hedenbergite, garnet, copper pyrites, mispickel, pyrrhotite, fluor, &c. The crystals are dark brown to dark violet, and are somewhat prismatic in habit instead of the more usual sharp-edged or thin-tabular habit characteristic of the mineral. Analysis IV, by Kajiura.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	Mn ₂ O ₃	B ₂ O ₃	CaO.	MgO.	Na ₂ O.	K ₂ O.	H ₂ O.	Total.
IV.	41.87	19.25	11.79	5.62	1.59	17.75	trace	1.79	trace	0.87	100.53

Biotite? The pegmatite at Tanokamiyana in Ōmi contains several varieties of mica. Analysis V, by Kodera, is of dark green plates of biotite (?) which is nearly optically uniaxial.

Zinnwaldite (?), from the same place, is reddish-brown to nearly colourless; the plane of the optic axes is parallel to the plane of symmetry, and the axial angle is large. Analysis VI by Kodera.

A dirty, dark brown mica from Kai gave VII, by Hida.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	MnO.	CaO.	MgO.	K ₂ O.	Na ₂ O.	H ₂ O.	F.	Total.
V.	35.87	0.35	22.69	20.90	—	5.65	—	0.82	6.70	2.52	1.00	3.19	99.19
VI.	46.13	2.77	17.03	4.64	—	6.27	—	0.48	10.09	4.12	2.31	6.89	100.68
VII.	38.45	—	15.53	22.73	1.71	—	2.22	7.85	2.25	2.16	7.20	—	100.10

Hedenbergite occurs as large crystals in biotite-hornfels associated with axinite, &c. (*ante*) at Ōkuradani. Analysis VIII:

	SiO ₂	FeO.	MnO.	CaO.	MgO.	K ₂ O.	Na ₂ O.	H ₂ O.	Total.
VIII.	47.13	24.46	0.73	23.23	2.40	0.13	0.98	1.48	100.54

Orthoclase and *Microcline*. Several types of potash feldspars occur in druses in pegmatite at Tanokamiyama, Ōmi. Analysis IX of white, translucent crystals, usually twinned, and up to 20 cm. long. Analysis X, reddish-white to flesh-red crystals occurring with topaz; XI and XII, of glassy crystals mostly twinned (Analysis IX—XII by Kodera).

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	K ₂ O	Na ₂ O	Total
IX.	64.78	17.86	1.46	0.14	0.11	12.87	2.25	99.47
X.	64.62	21.00	0.33	0.20	0.09	12.22	2.41	100.87
XI.	63.77	19.52	1.39	—	0.08	13.70	1.84	100.30
XII.	64.98	22.17	0.32	—	0.86	10.59	0.60	99.52

Sphene. Small yellow crystals in diorite at Kamioka in Hida gave analysis XIII, by Yoshida.

Heulandite. White, translucent crystals showing optical anomalies, from Ohara, gave analysis XIV, by Shinowara.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	H ₂ O	Total
XIII.	30.81	40.21	0.61	0.51	26.42	1.21	—	99.77
XIV.	58.4	—	14.4	—	12.2	—	14.9	99.9

L. J. S.

New Minerals from Franklin, New Jersey. By SAMUEL L. PENFIELD and CHARLES H. WARREN (*Amer. J. Sci.*, 1899, [iv], 8, 339—353).—The new minerals were found in the zinc mines at Franklin, in association with native copper and lead (Abstr., 1898, ii, 602), clinohedrite (Abstr., 1898, ii, 607), roëblingite (Abstr., 1897, ii, 563), axinite, willemite, datolite, garnet, phlogopite, &c. They are probably of metamorphic (pneumatolitic) origin.

Hancockite. This occurs as brownish-red, cellular masses of minute, lath-shaped crystals, which are monoclinic, and have nearly the same habit and angles as epidote. Single crystals are yellowish-brown with a vitreous lustre, and are pleochroic. Sp. gr. 4.030. Analysis by Warren gave:

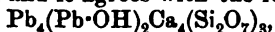
SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	Mn ₂ O ₃	PbO	MnO	MgO	CaO
30.99	17.89	12.33	1.38	18.53	2.12	0.52	11.50
SiO	H ₂ O	Total					
3.89	1.62	100.77					

This gives the epidote formula, $H_2R''R'''Si_6O_{26}$, or $R''_2(R'''OH)R'''_2(SiO_4)_3$;

but the mineral differs from epidote in containing lead and strontium isomorphous with calcium. Like epidote, the mineral is decomposed by hydrochloric acid only after ignition.

Glaucokhroite. This occurs embedded in nasonite as columnar, orthorhombic crystals of a bluish-green colour. Twins are sometimes present with individuals intercrossing at angles of about 60°. The parameters are approximately $a:b:c=0.440:1:0.566$; these ratios, as well as the optical characters, indicate that the mineral belongs to the olivine group. Sp. gr. 3.407. Analysis I, by Warren, gives the formula $CaMnSiO_4$, showing that the mineral takes a place next to monticellite ($CaMgSiO_4$).

Nasonite. This is white and massive, with a greasy to adamantine lustre. Thin sections under the microscope show the mineral to be crystalline and optically uniaxial; the system is probably tetragonal. Sp. gr. 5.425. After deducting 2.16 per cent. of clinochrodite ($\text{H}_2\text{CaZnSiO}_5$), analysis II (by Warren) gives the formula $\text{Pb}_6\text{Ca}_4\text{Cl}_2(\text{Si}_2\text{O}_7)_3 = \text{Pb}_4(\text{PbCl})_2\text{Ca}_4(\text{Si}_2\text{O}_7)_3$. This is closely related to the tetragonal ganomalite from Sweden, of which the formula is usually given as $\text{Pb}_5\text{Ca}_2\text{Si}_3\text{O}_{11} = \text{Pb}_4(\text{Pb}_2\text{O})''\text{Ca}_4(\text{Si}_2\text{O}_7)_3$. Lindström's analysis (1883) of ganomalite shows the presence of small quantities of water and chlorine, and it agrees with the formula



which is now proposed for ganomalite. Nasonite therefore differs from ganomalite in containing chlorine in place of hydroxyl.

The acid, $\text{H}_6\text{Si}_2\text{O}_7$, of which nasonite and ganomalite, as well as cordierite, barysilite ($\text{Pb}_3\text{Si}_2\text{O}_7$) and hardystonite (Abstr., 1899, ii, 435) are salts, is intermediate between ortho- and meta-silicic acids, or it may be considered as $2\text{Si}(\text{OH})_4 - \text{H}_2\text{O}$. For this acid, which is usually called diorthosilicic, the name *mesosilicic acid* is proposed.

Leucophaenicite. This is of a purplish-red or raspberry colour; it has a crystalline structure, though the crystal system, probably monoclinic, could not be determined. Sp. gr. 3.848. Analysis III (also Na_2O , 0.39; K_2O , 0.24), by Warren, agrees with the formula $\text{H}_2\text{R}_7\text{Si}_3\text{O}_{14}$, or, as the water is not expelled below a red heat, $\text{R}_5(\text{R}\cdot\text{OH})_2(\text{SiO}_4)_8$. This represents a basic orthosilicate, and the mineral is therefore a manganese humite with hydroxyl in place of fluorine.

	SiO_2	PbO.	MnO.	ZnO.	MgO.	CaO.	FeO.	Cl.	H_2O .	Total.
I.	31.48	1.74	38.00	—	—	28.95	trace	—	—	100.17
II.	18.47	65.68	0.83	0.82	—	11.20	0.10	2.81	0.26	99.54
III.	26.36	—	60.63	3.87	0.21	5.67	trace	—	2.64	100.01

L. J. S.

Hydrated Aluminium Silicates and Clays. By KONSTANTIN D. GLINKA (*Zeit. Kryst. Min.*, 1899, 32, 79—81; from *Mém. Inst. agron. forest. à Novo-Alexandria* [Gouv. Lublin], 1899, 12, 41—84).—Various clays were found to contain quartz, orthoclase, muscovite, rutile, zircon, tourmaline and garnet, together with kaolin, bauxite and diaspor, but no zeolites. Quartz and aluminium hydroxides may occur together, and in this case their presence will not be indicated by a bulk analysis of the clay. Their presence is, however, indicated when the material, after ignition, is treated with a 33 per cent. solution of potassium hydroxide; under these circumstances, most of the silica, but very little of the alumina, goes into solution. Several other experiments of a similar nature were made on clays and various silicates, the object being to determine the constituent minerals of clays. L. J. S.

Stokesite, a New Mineral from Cornwall. By ARTHUR HUTCHINSON (*Phil. Mag.*, 1899, [v], 48, 480—481).—A preliminary notice is given of a new mineral, of which only a single crystal, about 10 mm. long, has been found. It is colourless and transparent. System, orthorhombic [$a:b:c = 0.3479:1:0.8117$]. Sp. gr. 3.185,

H=6. The lustre is vitreous. Analysis gives the formula $\text{CaO}, \text{SnO}_2, 3\text{SiO}_2, 2\text{H}_2\text{O}$ (compare *Nature*, 1899, 61, 119). L. J. S.

Andesites from Maine. By HERBERT E. GREGORY (*Amer. J. Sci.*, 1899, [iv], 8, 359—369).—A description is given of the andesites of the Aroostook volcanic area of northern Maine. An analysis by Hillebrand is quoted. L. J. S.

Hot Sulphur Spring of Deutsch-Altenburg. By ERNEST LUDWIG and THEODOR PANZER (*Chem. Centr.*, 1899, ii, 402; from *Wien. klin. Wochensch.*, 12, 708—710).—The hot sulphur spring of Deutsch-Altenburg belongs to the same type as the hot salt-sulphur springs of Aachen and of the Hercules bath in Mevania. It is a clear water, with a strong odour of hydrogen sulphide, and becomes turbid on keeping and deposits sulphur. It has a sp. gr. 1·00289 at 18·70° and contains traces of caesium, rubidium, titanic oxide and formic acid. A full analysis is given. E. W. W.

Origin of Graubünden Mineral Waters. By GUSTAV NUSSBERGER (*Jahresber. Naturforsch. Ges. Graubündens*, 1899, 42, 1—35. Compare Abstr., 1897, ii, 569).—A detailed account is given of the mineral waters of the Canton Graubünden (= Grisons), Switzerland, and their origin discussed. Several analyses are quoted. L. J. S.

Mineral Waters of Lutraki, Greece. By ANASTASIOS K. DAMBERGIS (*Chem. Centr.*, 1899, ii, 568; from *Oesterr. Chem.-Zeit.*, 2, 437).—The mineral waters of Lutraki, on the north coast of the Gulf of Corinth, consist of three groups, which differ in temperature and quantity, but have an almost identical composition. The clear, odourless water has a sweet taste, with a somewhat saline after-taste, does not become turbid on exposure to air, and leaves no residue as it flows from the spring. The group containing the most dissolved matter contains 1·912 grams of dissolved substances per litre, has a temperature of 31°, and a sp. gr. 1·0018. An analysis is quoted. The springs belong to the class of alkaline calcareous hot springs. E. W. W.

The Water of Monsummano. By PIETRO ALBERTONI and GIUSTO CORONEDI (*Chem. Centr.*, 1899, ii, 591—592; from *Ann. Farm. Chim.*, 1899, 214—235).—The water of Monsummano has a temperature of 32° and a sp. gr. 1·000154, and 10,000 parts leave a residue of 13·012 dried at 180°. An analysis of the residue is quoted. In the original paper, the action of this water is discussed on the basis of the ion theory and clinical experiments on its therapeutic and physiological effects are also described. The small amount of calcium and magnesium salts present, and its power of dissolving uric acid, are remarkable. Uric acid dialyses much more readily into this water than into distilled water. E. W. W.

Physiological Chemistry.

Influence of Bile, of Acid, and of Alkalis on the Proteolytic Action of Pancreatic Juice. By BENJAMIN K. RACHFORD (*J. Physiol.*, 1899, 25, 165—178. Compare Abstr., 1899, ii, 567).—Experiments were made with the pancreatic juice (not extracts, as Chittenden used) and bile of the rabbit. These confirm the conclusion arrived at previously, although denied by Chittenden, that bile much favours the proteolytic action of the juice. Bile, however, retards the albuminous fermentations carried on by organised ferments. When pancreatic juice is added to fibrin half saturated with hydrochloric acid, it does as much work as on neutral fibrin. If the fibrin is nine-tenths saturated with the acid, proteolysis is retarded; this retardation also occurs in the presence of bile. Free hydrochloric acid greatly inhibits, but does not destroy, the proteolytic action, whilst sodium carbonate is favourable, especially in dilute solutions of pancreatic juice. The general conclusion is drawn that the conditions in the entire small intestine are favourable to the proteolytic activity of pancreatic juice.

W. D. H.

The Influence of Removal of Water on Metabolism and Circulation. By WALTHER STRAUB (*Zeit. Biol.*, 1899, 33, 537—566).—The effect of sodium chloride in producing a slight increase of proteid katabolism is attributed to its diuretic action, water being removed from the tissues. The present experiments on dogs were designed to test this theory by a removal of water from the food; this was found to increase proteid katabolism, but to have no influence on fat. The blood pressure is not altered, but the quantity of water lost by skin and lungs is slightly lessened.

W. D. H.

Influence of the Kind and Amount of Nutriment on Metabolism. By EDUARD PFLÜGER (*Pflüger's Archiv*, 1899, 77, 425—482).—The object of the paper is to show that proteid is the great source of energy; it increases metabolism, and raises the resistance and power of the animal; it does so by increasing the substance of the living cells, sometimes even doubling their weight. Fat and carbohydrate have no such power. Fat never arises from proteid in the animal body. Man cannot take all his nutriment in the form of proteid simply because of the limitation which exists in his digesting power.

W. D. H.

Metabolism of Nucleins. By T. H. MILROY and J. MALCOLM (*J. Physiol.*, 1899, 25, 105—130. Compare Abstr., 1899, ii, 479).—In a case of lymphatic leucocythæmia, the phosphoric oxide excreted was diminished both absolutely and relatively to the nitrogen excreted, whilst the excretion of uric acid and alloxuric bases was hardly affected. In a case of medullary leucocythæmia where the number of leucocytes was falling, the excretion of phosphoric oxide underwent no diminution, whilst the alloxuric excretion varied greatly. An investi-

gation of the characters of the granules in the colourless corpuscles of marrow and blood was carried out by micro-chemical means. Nucleic acid, and its principal decomposition products (thymic acid, adenine, guanine, cytosine) alter the staining affinities of oxyphil granules, making them finally basophil. The granules are nucleoproteid, and the action of the nucleic acid is to cause the cell to give up the albumin and leave a more acid residue, nuclein. The subsequent discharge of the residue leads to an increase of excreted phosphoric anhydride; this probably occurs in the body when nucleic acid is liberated. The granules readily undergo changes, and a study of them is important, for these affect the general metabolism.

W. D. H.

The Proteid-sparing Action of Alcohol. By RUDOLF ROSEMAN (Pflüger's Archiv, 1899, '77, 405—424).—Miura, Schmidt, and Schönesseffen found that alcohol has no proteid-sparing action. The present paper confirms this, and criticises Neumann's recent work, which appeared to show the contrary.

W. D. H.

Koppe's Theory of the Formation of Hydrochloric Acid in the Stomach. By JOHN A. WESENER (Pflüger's Archiv, 1899, '77, 483—484).—Koppe's theory of the formation of hydrochloric acid in the stomach is that ionisation of the sodium chloride in the stomach, and of the acid carbonates and phosphates in the blood, occurs, and that an exchange of the hydrogen ions in the blood, and sodium ions of the stomach then takes place. The following experiments show this cannot be the case, but that the acid is the result of cell activity. If the stomach is well washed out, and a 0.7 per cent. solution of sodium chloride introduced, there is no formation of free acid, but if the stomach be irritated by the rotation of a revolving sound in its interior, whether the sodium chloride solution be there or not, free hydrochloric acid appears, reaching a percentage of 0.1 in a few minutes.

W. D. H.

Origin of Fat from Proteid. By EDUARD PFLÜGER (Pflüger's Archiv, 1899, '77, 521—554).—Polemical. Pflüger is well known to be an unbeliever in Voit's doctrine that fat can originate from proteid in the body; his remarks here are mainly directed against Max Cremer, the latest exponent of Voit's theory.

W. D. H.

Phosphorus in Muscle. By J. J. R. MACLEOD (Zeit. physiol. Chem., 1899, 28, 535—558).—By muscular work, the organically united phosphorus in aqueous extracts of muscle is greatly diminished but the inorganic phosphates are increased. The lessening is due partly to a diminution of phosphorus in nucleon, but especially to that in organic phosphorus compounds other than nucleon.

W. D. H.

Sodium Chloride in Cartilage. By GUSTAV VON BUNGE (Zeit. physiol. Chem., 1899, 28, 452—458).—Cartilage, one of the oldest tissues, phylogenetically, is the richest of the tissues in sodium. A number of analyses of cartilage from mammals show that the sodium is most abundant in embryonic life, and least so in old animals. Com-

paring the cartilage of adult selachians with that of adult and embryonic mammals, the former is richest in sodium; doubtless the sodium is principally present as chloride.

W. D. H.

The Lactase of the Pancreas. By ERNST WEINLAND (*Zeit. Biol.* 1899, 38, 607—617).—In both young and adult dogs, the pancreas in virtue of a lactase converts lactose into dextrose and galactose, this power being increased by a milk diet. By prolonged boiling with citric acid, lactose is similarly acted on. There is no evidence of any intermediate substance between lactose and its hydrolytic products.

W. D. H.

The Retention of Phytosterol in the Animal Body after Feeding with Cotton-seed Oil. By C. VIRCHOW (*Chem. Centr.*, 1899, ii, 395; from *Zeit. Unters. Nahr. u. Genussmittel.*, 2, 559—575. Compare Abstr., 1899, ii, 689).—The results of experiments in which dogs and pigs were fed with cotton-seed oil showed that phytosterol did not pass into the fat, so that the presence of phytosterol in lard is important evidence of adulteration.

It was found that glycerides of hydroxy-fatty acids passed into the fatty tissues.

N. H. J. M.

Albumin in the Cell of the Queen Bee. By P. SÜSS (*Chem. Centr.*, 1899, ii, 560; from *Pharm. Centr.-H.*, 40, 458).—More than a gram of a yellowish-white, rather transparent mass with the appearance of salve was found on the floor of a queen bee cell and proved to be albumin. A. KLETT (*ibid.*, 502) points out that it has been long known that the cell of the queen bee contains albumin, and, indeed, differs from those of the working bees only in containing a larger proportion of it.

E. W. W.

Death Temperature of Marine Organisms. By HORACE M. VERNON (*J. Physiol.*, 1899, 25, 131—138).—In a number of marine animals belonging to various groups, the death temperature is generally a little higher than the paralysis temperature, and varies from 32·5° to 43·5°. Even among transparent pelagic animals, the differences are nearly as great. The differences can only be partly explained by the differences in the amount of solids in the tissues, hence protoplasm must vary chemically as well as physically. From observations on the death temperature of echinoid embryos, it is shown that it rises with the progress of development.

W. D. H.

Degradation of Caffeine in the Organism of the Dog. By MARTIN KRÜGER (*Ber.*, 1899, 32, 3336—3337. Compare Abstr., 1898, i, 699; 1899, ii, 233, and this vol., ii, 30 and 31).—Caffeine (1:4:6-trimethylxanthine) was given to a rabbit during 22 days in daily doses of 0·1 gram, the animal being fed on oatmeal and cabbage; the urine was found to contain paraxanthine (1:6-dimethylxanthine), heteroxanthine (1-methylxanthine), and 6-methylxanthine. In the systems of the rabbit and man, the methyl group in position 4 appears to be most labile, whilst in the dog the alkyl radicle in position 1 is most readily removed.

G. T. M.

Influence of Theine on the Excretion of Alkalis in the Urine. By K. KATSUYAMA, T. KUWAHARA, and K. SENO (*Zeit. physiol. Chem.*, 1899, 28, 587—594).—Experiments on rabbits show that the administration of theine increases the output of alkali in the urine; there is increase in sodium, but not in potassium. W. D. H.

Estimation of the Reducing Substances in Urine by Peške's Method. By A. GREGOR (*Chem. Centr.*, 1899, ii, 231; from *Centr. Krank. Harn. und Sexualorgane*, 10, 240).—The method of Peške (*Proc.*, 1895, 11, 43) for the estimation of dextrose is equally applicable to urine. The urine requires to be diluted. Normal urine shows a reducing power varying from 0.0825 to 0.347 per cent. It rises after a meal, more strongly after an amylaceous than after a flesh diet. It is constant during the night, having the same value (0.085 per cent.) as when fasting or employing a pure flesh diet. Excessive use of carbohydrates does not increase it; alcohol does so. It is lowered by hard, muscular work. M. J. S.

Relations between the Diuretic Effects and Osmotic Properties of Sugars. By E. HÉDON and J. ARBOUS (*Compt. rend.*, 1899, 129, 778—781).—Sugars are toxic only in very large doses, and can be injected into the animal system without producing either immediate or subsequent accidents. The maximum diuretic effect is produced by a particular dose at a particular degree of concentration, which varies with different sugars. There is an approximately constant relation, the *diuretic coefficient D*, between the quantity of sugar solution injected and the volume of urine eliminated, but this coefficient varies with the concentration of the solution; with dextrose solution containing 25 per cent. it is 2.8, with 50 per cent. 4.8, and with 10 per cent. 1.0. The coefficient also varies with different sugars at the same degree of concentration; with dextrose at 25 per cent. it is 2.8; levulose and galactose, 2.4; sucrose, 2.0; lactose and maltose, 2.2; raffinose, 0.9; arabinose, 3.4; erythritol, 4.0. It follows that the diuretic coefficients of these sugars vary inversely as their molecular weights, but directly as their osmotic pressures. Some sugars of the same molecular weights and osmotic pressures have not, however, exactly the same diuretic coefficients, but these differences are probably due to the different chemical functions of the sugars or to the fact that different proportions of them are consumed by the organism.

The toxic effect of the sugars generally follows the same order as their diuretic coefficients. The toxic dose is 30—35 grams per kilogram of body weight in the case of sucrose; 20—25 grams with dextrose; and 5 grams with arabinose and erythritol. C. H. B.

[Physiological Action of] Cyanotetramethylpyridone. By LUIGI SABBATANI (*Chem. Centr.*, 1899, ii, 528; from *Atti Real. Accad. Torino*, 34).—A 1 per cent. solution of the 3-cyano-1:2:3:4-tetramethylpyridone, prepared by Guareschi (*Atti Real. Accad. Torino*, 34), has an extremely bitter taste, which is similar to that of quinine and magnesium sulphate. With Bouchardat's reagent, this compound forms a reddish-brown precipitate which easily decomposes and with Nessler's reagent, even in very dilute solutions, it gives a lemon-yellow,

amorphous precipitate, but its presence in urine could not be detected by means of these reactions. Physiologically it proved to be very active, but comparatively harmless, its operation being of short duration and chiefly affecting the spinal marrow. When dropped into the eye, it induces myosis and subcutaneous injections have a purgative action. Dilute solutions of the pyridone cause more or less violent contraction of the muscles.

E. W. W.

Physiological Action of Quinosol [*o*-Hydroxyquinoline-sulphonic Acid]. By CARL BRAHM (*Zeit. physiol. Chem.*, 1899, 28, 439—451).—The urine of animals (dogs and rabbits) which had been dosed with quinosol deposits crystals of *o*-hydroxyquinoline-glycuronic acid, $C_{15}H_{15}O_7N + 2H_2O$, and this does not show a definite melting point, but turns yellow at 102—105° and decomposes at 151°; it dissolves in 815 parts of water at 15°, but readily in hot water, the solution being strongly acid; it does not reduce Fehling's solution. The cadmium, strontium, barium, and potassium salts were prepared; an aqueous solution of the latter is laevorotatory $[\alpha]_D^{20}$ 83.83—76.59°. When boiled with dilute acids, the acid is resolved into *o*-hydroxyquinoline and glycuronic acid.

Nothing certain is known of the origin of glycuronic acid in the body; the administration of α -methylglucoside did not lead to its appearance in the urine.

W. D. H.

Action of Lymphagogues on the Proteids of Blood and Lymph. By DMITRI J. TIMOFÉFFSKY (*Zeit. Biol.*, 1899, 38, 618—651).—The percentage of globulin in relation to the total proteid is higher in normal blood than in lymph. Lymphagogues of Heidenhain's first kind increase this relationship, either only in the lymph (for example, with toxins and crayfish extract), or in both lymph and blood (as when peptone is used); this, however, lasts but a short time, the normal ratio being quickly re-established. The change in the proteids has no direct relation to the increase of lymph secretion, or the rise in the total proteids of the lymph.

W. D. H.

Acute Alcoholism: Estimation of Alcohol in the Blood and the Tissues. By NESTOR GRÉHANT (*Compt. rend.*, 1899, 129, 746—748).—A 10 per cent. solution of alcohol was introduced into the stomach of dogs, in quantity corresponding with 5 c.c. of absolute alcohol per kilogram of body weight. After half-an-hour, 10 c.c. of arterial blood were withdrawn, and the alcohol in it estimated by distillation and titration with potassium dichromate, this operation being repeated every half-hour. After an hour and a half, the quantity of alcohol in the blood becomes constant and is 0.57 c.c. per 100 c.c. of blood. After four-and-a-half to five hours, the quantity of alcohol begins to be less and the animal slowly recovers. In the case of a dog killed by bleeding from the carotid artery, the following quantities of alcohol were found in the various tissues: brain, 0.41 c.c.; muscles, 0.33 c.c.; liver, 0.325 c.c.; kidneys, 0.39 c.c. per 100 grams of tissue in each case.

C. H. B.

Effect of Poisons on the Eye-Muscles. By GUILLERY (*Pflüger's Archiv*, 1899, 77, 321—404).—A considerable number of measure-

ments of the movements of the ocular muscles were made under normal circumstances, and these were compared with others made under the influence of various poisons. Alcohol lessens the contractive-energy: this is principally manifested by the internal recti. The paralysing action of morphine falls also chiefly on the same muscles; the action on the external muscles begins later. The action of chloral hydrate on the eye-muscles is shown by quite small doses; the pupil is enlarged, and the near point is made more distant. Much larger doses of paraldehyde are necessary to produce corresponding effects; the action of sulphonal and trional is small but unmistakable. Cocaine has little or no action beyond that on the pupil. Chloroform is the most active of the inhalation poisons examined.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Do the Bacteria of Alinit assimilate Atmospheric Nitrogen? By JULIUS STOKLASA (*Chem. Centr.*, 1899, ii, 132; from *Centr. Bakt. Parasit.*, II., 5, 350—354).—Whilst Lauck (*Chem. Centr.*, 1899, i, 443 and 858, and *Centr. Bakt. Parasit.*, II., 5, 20, 54, and 87) believes that the alinit bacteria are *Bacillus subtilis*, the author considers them to be *B. megatherium*. The two bacilli differ essentially; the former converts nitrates into nitrites, the latter into nitrites and ammonia.

In a mixture of xylose and galactose (3 : 1) with mineral matter and a little nitrogen (as peptone) the alinit bacteria develop quickly and fix free nitrogen. In presence of much combined nitrogen there is no fixation. In the same mixture, *B. subtilis* grows less and there is only a slight fixation of free nitrogen.

N. H. J. M.

Influence of Organic Substances on the Work of Nitrifying Organisms. By SERGEI WINOGRADSKY and V. OMELIANSKY (*Chem. Centr.*, 1899, ii, 132—133, 217, and 264; from *Centr. Bakt. Parasit.*, II., 5, 329—343, 377—387, and 429—440).—Sodium carbonate is essential for the growth of nitric and nitrous organisms.

In the case of nitrate organisms, the oxidation of the nitrite and the growth of the microbe are inseparable. Peptone in excessive amount cannot alter the specific function of the microbe, but destroys or completely checks it under certain conditions. Addition of 0.025 per cent. of dextrose is favourable; the limit of favourable action is reached when 0.3 per cent. is present. Urea is without effect when the amount is only 0.05 per cent.; 0.5—0.8 per cent. hinders nitrification; asparagine (0.05 per cent.) is injurious, and glycerol behaves similarly.

Infusion of hay (14 per cent.) is beneficial; addition of urine (2 per cent.) resulted in the time required for oxidation being increased five times. Broth (8 per cent.) had no effect. Urea is without action

and it is to ammonia that the depressing effect of urine is attributed (compare Warington, Trans., 1891, 521). Sodium acetate (2 per cent.) checked oxidation, whilst the butyrate had only a slight effect. Iron salts seem to assist the process.

The nitrite bacterium is much more sensitive to nitrogenous substances such as peptone and asparagine than the nitrate bacterium. The more complex, unstable, and, for most microbes, the more assimilable the substance, the more injurious is its effect on nitric organisms. The following arrangement of nitrogenous substances, according to their nutritive value, also corresponds with their anti-nitrifying effect: peptone, dextrose, asparagine, urea, acetates, and butyrates.

N. H. J. M.

Nitrification of Organic Nitrogen. By V. OMELIANSKI (*Chem. Centr.*, 1899, ii, 347—348; from *Centr. Bakt. Parasit.*, II., 5, 473—490).—Experiments with amides, proteids, urine, &c., showed that the nitrifying organisms are not able to attack organic nitrogen; the nitrogen must be first converted into ammonia.

A cultivation containing an ammonia microbe (*Bacillus ramosus*), a nitrite bacterium, and a nitrate bacterium converted organic nitrogen successively into ammonia, and nitrous and nitric acids. If the nitrite bacterium is omitted, only ammonia is formed, whilst if the nitrate bacterium is omitted, the change stops after production of nitrites.

N. H. J. M.

Micro-organisms observed in the Formation of Nitrates. By ALBERT STUTZER and R. HARTLEB (*Chem. Centr.*, 1899, ii, 448—449; from *Mitt. landw. Inst. k. Univ. Breslau*, Heft. 2).—A nitric organism, *Nitromicrobium germinans*, which is not a bacterium, was obtained from soil. It only oxidises nitrites to nitrates. As nitrogenous food, it can utilise ammonium compounds and nitrates as well as nitrites, but not complex compounds such as peptone and the constituents of broth. It utilises free carbon dioxide, but not carbonates, and it cannot assimilate the carbon compounds, such as sugars, usually employed for bacteria.

N. H. J. M.

Action of *Bacillus Coli* and *Bacillus D'Eberth* on Nitrates. By LÉON GRIMBERT (*Ann. de l'Inst. Pasteur*, 1899, 13, 67—76).—Nitrogen is not evolved, and only a trace of nitrite is formed, when *Bacillus coli* and *B. d'Eberth* are cultivated in a 1 per cent. peptone solution containing 1 per cent. of a nitrate. If, however, they are cultivated in peptonised broth containing a nitrate, then a part of this nitrate is decomposed, nitrogen and carbon dioxide are evolved, and a considerable amount of nitrite remains in solution. With *B. pyocyaneus* the whole of the gas evolved consists of nitrogen, no carbon dioxide being formed. Similar results are obtained with a peptone solution containing extract of meat and a nitrate. The evolution of nitrogen is no doubt due to a secondary reaction between the nitrous acid produced by the reduction of the nitrate by the bacillus, and the amino-nitrogen contained in the broth or extract, for the amount of nitrogen evolved is twice that corresponding with the amount of nitrate decomposed and half that corresponding with the aminic nitrogen

contained in the broth or extract. Peptone itself contains a small amount of aminic nitrogen, and it is therefore possible for *B. coli* and *B. d'Eberth* to evolve nitrogen from a 5 per cent. peptone solution, for the amount of peptone in the solution is sufficient to furnish the aminic nitrogen required. Nitrogen is evolved when *B. d'Escherich* and *B. d'Eberth* are cultivated in a peptone solution containing potassium nitrite. H. R. LÆ S.

Denitrification. By KURT WOLFF (*Chem. Centr.*, 1899, ii, 133—134; from *Hygien. Rundsch.*, 9, 538—547).—Besides the eleven known denitrifying organisms, *Bacillus fluorescens liquefaciens* possesses this property, although it will not reduce nitrates in pure well or river water, or in milk.

As regards the question whether denitrifying organisms obtain oxygen wholly, or in part, from nitrates, it was found that the same amount of atmospheric oxygen was absorbed whether nitrates were present or not.

On inoculating peptone containing calcium nitrate with *B. fluorescens*, nitrogen was eliminated, nitrous anhydride being formed as an intermediate product. Calcium carbonate was formed; the liberation of nitrogen cannot therefore be the result of the interaction of nitrate and amino-compounds in acid solution, as Marpmann suggested (*Chem. Centr.*, 1899, i, 702, and *Centr. Bakt. Parasit.*, II, 5, 67). The fact that with abundant aëration nitrogen is not liberated may be due to the removal of most of the carbon dioxide. Other examples of microbes which only denitrify in presence of plenty of carbon dioxide are given.

Ordinary pressed yeast destroys nitrates completely both in broth containing sodium nitrate or with calcium nitrate. This is not a case of action of pure yeast, as numerous bacteria are present. Fermentation can take place without liberation of free nitrogen from the nitrate present. N. H. J. M.

Which forms of Carbohydrates do Denitrification Bacteria require for their Vital Processes? By JULIUS STOKLASA (*Bied. Centr.*, 1899, 27, 707—708; from *Zeit. landw. Versuchswesen Oesterr.*, 1898, i, 371).—The activity of denitrification bacteria was found to be greatest in presence of xylose; arabinose is a less suitable food. Experiments were also made with pure dextrose, lævulose, galactose, and sucrose.

In experiments with *Bacillus denitrificans*, it was found that oats grew normally in presence of dextrose, whilst with xylose the yield was reduced to about one-fourth as compared with that of pots manured with nitrate and superphosphate. With arabinose, the results were similar to those obtained with glucose.

Bacillus megatherium and *B. mycoides* had no effect on the growth of oats in presence of xylose, nitrate, and phosphoric acid. It is probable that both bacteria reduce the nitrate to ammonia and also accumulate atmospheric nitrogen in the soil. N. H. J. M.

Fermentation Experiments with Trehalose. By ARMINIUS BAU (*Chem. Centr.*, 1899, ii, 130—131; from *Woch. Brauerei*, 16, 305—306).—The constituent of certain yeasts which causes the break-

ing up of trehalose into dextrose must be of a nature differing from that of ordinary enzymes. Invertin has no effect on trehalose. It cannot be assumed that trehalose, which Bourquelot found in mould fungi, occurs in genuine yeasts. The hydration of trehalose is attributed to the living protoplasm or its constituents.

Trehalose is not suitable for distinguishing between different yeasts.

N. H. J. M.

Cellulose Enzymes. By FREDERICK C. NEWCOMBE (*Chem. Centr.*, 1899, ii, 129; from *Annals of Bot.*, 13, No. 49).—The extract of *Aspergillus Oryzae* attacks reserve cellulose more vigorously than starch; the enzymes of *Lupinus albus* and of *Phoenix dactylifera* behave similarly, but the latter hydrolyses somewhat more starch than *Lupinus albus*, whilst the enzyme acts very strongly on cellulose and less on starch than the extracts of *Lupinus* and *Phoenix*. The enzymes of barley malt, besides those already mentioned, attack cellulose when very much diluted. The effect of all these ferments is to render the cell-walls more and more transparent. The enzymes of *Lupinus* and *Phoenix* may be considered as cytase, and are not to be regarded as diastase.

N. H. J. M.

Raffinose as a Carbohydrate for the Nutrition of *Aspergillus Niger*. By HENRI GILLOT (*Chem. Centr.*, 1899, ii, 129—130; from *Bul. Acad. roy. Belg.*, 1899, 221—226).—When sucrose is employed for the nutrition of *Aspergillus niger*, it is inverted by a diastase before being assimilated, oxalic acid being formed as an intermediate product. In a similar manner, raffinose is inverted; the melibiose produced is further hydrolysed to dextrose and levulose. Like sucrose, raffinose is completely utilised, and to the same extent in a given length of time. Oxalic acid is formed.

N. H. J. M.

Nitrogen Nutrition of Leguminous Plants. By JAN LUTOSLAWSKI (*Bied. Centr.*, 1897, 27, 688—689; from *Ber. physiol. Lab. landw. Inst. Univ. Halle*, 1898).—Peas were grown in pots containing sandy loam (6·6 kilograms) from a field on which peas had been grown the year before. Mineral manure was given to each pot, and to some sodium nitrate (1·277 grams) as well. Plants were taken up at five periods, (1) after the end of the germinating process (8th to 10th leaf), (2) commencement of flowering, (3) full flower, (4) after flowering, (5) ripe. The balance of nitrogen, taking into account the amounts in produce and in soil, gave the following gain per cent. of the original nitrogen in soil and seed (9·269 grams), (1) without, and (2) with nitrate at the different periods:

	I.	II.	III.	IV.	V.
1.	1·0	1·65	3·14	5·17	3·40
2.	0·0	1·45	1·89	2·95	2·20

in absence of nitrate, fixation of nitrogen commenced soon after the germinating period, whilst with nitrate it was later. For green manuring and for feeding, peas should be ploughed in or cut when fruit begins to be formed; or, in unfavourable weather, at earlier periods. Similar experiments with vetches failed in absence of nitrate.

N. H. J. M.

Chemistry of the Cell. By JAN SOSNOWSKI (*Chem. Centr.*, 1899, ii, 587; from *Centr. physiol.*, 13, 267—270).—The infusoriæ obtained from ordinary hay infusion are for the most part easily soluble in a 0.2 per cent. solution of an alkali hydroxide and in a 0.3 per cent. solution of sodium carbonate, only a few lustrous granules remaining undissolved. The solutions give the biuret reaction and the *Paramæcium* gives Millon's reaction. They are only attacked by pepsin-hydrochloric acid with difficulty. The extracts obtained by grinding the infusoriæ with quartz and treating with water, contain albumin which cannot be coagulated when the solutions are neutral, but is partly precipitated by adding sodium chloride or acids. The proteids are completely precipitated from the aqueous extract by barium hydroxide, and the precipitate contains phosphorus even after repeated treatment with dilute hydrochloric acid, alcohol, and ether. When the fat, lecithin, &c., have been removed from the cells by means of alcohol, only a portion of the residue is soluble in a 0.2 per cent. solution of sodium hydroxide, and the precipitate obtained by acidifying the alkaline solution with acetic acid contains phosphorus, gives the biuret reaction, and when boiled with phloroglucinol dissolved in hydrochloric acid exhibits the bands characteristic of the pentoses.

E. W. W.

Absorption of Iodine by Plants. By PAUL BOUBCET (*Compt. rend.*, 1899, 129, 768—770).—Twenty-eight plants belonging to nine different natural orders were grown in carefully prepared soil containing 0.83 mg. of iodine per kilog., and when the plants reached maturity they were cropped, and the proportion of iodine in them was determined. It was found to vary from *nil* (potato, gherkin, black radish, parsley, carrots, chicory, endive) to 0.32 (green haricots), 0.38 (*Beta cycla*), and even 0.94 (garlic) mg. per kilogram. Certain families, such as *Liliaceæ* and *Chenopodiaceæ*, absorb more iodine than others, such as *Solanaceæ* and *Umbelliferae*, but different species of the same order show considerable differences.

C. H. B.

Physiological Importance of Furfuroids in Sugar Beet. By JULIUS STOKLASA (*Chem. Centr.*, 1899, ii, 57—58; from *Zeit. Zucker-Ind. Böhmen*, 23, 387—397. Compare Abstr., 1899, ii, 792).—Inasmuch as pentosans are important constituents of the cell membranes, it may be concluded that they are formed from sucrose. As new organs containing pentosans develop in the second year of vegetation, the sucrose gradually disappears from the roots. In water-culture experiments with peas and maize, it was found that only a slight excess of furfuroids was produced in presence of sucrose as compared with dextrose; when, however, root heads of beet were fed under conditions of sterilisation with sucrose and dextrose respectively, in absence of carbon dioxide, it was found that a far greater amount of furfuroids was produced with sucrose than with dextrose. Potassium chloride assists the production of furfuroids.

Furfuroids are essential in the building up of cell membranes. The celluloses of the embryo are hydrolysed, and thus furnish the material for the production of the new hemicellulose group of the

seedlings. The hemicelluloses are transformed into lignocelluloses (which protect the roots from infection by parasitic fungi) and lignin substances.

N. H. J. M.

Occurrence of Indican in the Chlorophyll Grains of the Indigo Plants. By HANS MOLISCH (*Chem. Centr.*, 1899, ii, 482; from *Ber. deutsch. bot. Ges.*, 17, 228—233).—Indican is usually found in the mesophyll and external skin of the leaves of the indigo plant. Inside the green cell itself, it occurs mainly in the chlorophyll grains. It is best detected by converting it into indigo-blue by means of alcohol, ammonia, or chloroform vapour. The discovery of indican in the chlorophyll grains is the first proof of the presence of a glucoside containing nitrogen in the chlorophyll grains of the indigo plants.

E. W. W.

Histidine and Lysine in the Decomposition Products of the Proteid of Conifer Seeds. ERNST SCHULZE and ERNST WINTERSTEIN (*Zeit. physiol. Chem.*, 1899, 28, 459—464).—The proteid material of the seeds of various conifers has been shown to yield arginine on decomposition. The present research shows that, on decomposing the proteid with hydrochloric acid, histidine and lysine are also obtained. From 300 grams of dry material, 3 grams of histidine chloride, 19 grams of arginine nitrate, and 3 grams of lysine picrate were obtained.

W. D. H.

Histidine and Lysine in Seedlings. By ERNST SCHULZE (*Zeit. physiol. Chem.*, 1899, 28, 465—470).—From the present and previous work it is shown that from the seedlings of *Lupinus luteus* eight nitrogenous derivatives of proteid are obtainable, namely, asparagine, leucine, aminovaleric acid, tyrosine, phenylalanine, arginine, histidine, and lysine.

W. D. H.

Progressive Development of Essence of Bergamot. By EUGÈNE CHARABOT (*Compt. rend.*, 1899, 129, 728—731).—Analyses of two samples of essence of bergamot, one prepared from the green but fully developed fruit, and the other from the ripe fruit of the same trees, show that during the process of ripening, the free acids, calculated as acetic acid, decrease from 0.289 to 0.283, the total linalool from 40.5 to 35.5, the free linalool from 13.9 to 5.9, and the bergaptene from 5.9 to 5.5 per cent., whilst the linalyl acetate increases from 33.8 to 37.3 per cent. An increase is also observed in the terpenic constituents of the oil, but the relative proportions of limonene and dipentene remain unchanged. From these results, it is concluded that the primary development of the fruit is characterised by the active formation of linalool, and that during the subsequent ripening this reacts with the free acetic acid and is partly converted into linalyl acetate, partly dehydrated with the production of limonene and dipentene.

N. L.

Hazelnut Oil. By JOS. HANUŠ (*Chem. Centr.*, 1899, ii, 557—558; from *Zeit. Unters. Nahr.-Genussm.*, 2, 617—622).—From the ripe fruit of *Corylus avellana*, L., 50—60 per cent. of a clear, golden-yellow oil may be extracted by means of ether. It has a pleasant taste, an odour like

that of fresh butter, and the following constants: sp. gr., 0.9169 at 15°; saponification number, 193.7; iodine number, 90.2; Hehner's number, 95.6; Reichert-Meissl number, 0.99, and acetyl number, 3.2. The insoluble fatty acids have: saponification number, 200.6; iodine number, 90.6, and mean molecular weight of 279.0. The unsaturated fatty acids have: saponification number, 198.5; iodine number, 91.3; Maumene's number, 36.2, and mean molecular weight of 282. The oil does not give characteristic reactions with the usual reagents, but yields a greenish, semi-solid elaidin, and consists of 85 per cent. of oleic acid, 10 of palmitic and stearic acids, 10.41 of glycerol, and 0.5 of phytosterol. Oleic acid is the only unsaturated acid present, and the oil does not contain arachic acid.

E. W. W.

Cortex Lokri. By W. P. H. VAN DEN DRIESSEN MAREEUW (*Chem. Centr.*, 1899, ii, 589; from *Ned. Tijds. Pharm.*, 11, 227—234).—The bark, *Cortex Lokri*, is obtained from *Hymenaea Courbaril*; it contains 2.7 per cent. of catechin, 23.6 of catechu-tannic acid, 0.6 of fat, and 7.6 of ash.

E. W. W.

Saw Palmetto. By P. L. SHERMAN and C. H. BRIGGS (*Pharm. Archives*, 1899, 2, 101—116).—The saw palmetto (*Sabal serrulata*) is a tree which is found along the S.E. coast of the United States; the fruit is dark purple in colour, about the size of an olive, and consists of a juicy pulp and a very hard seed or nut. The fruit is pressed in a hydraulic press; when the juice is allowed to remain, an oil rises to the surface, in amount equal to about 1.5 per cent. of the fruit. This oil consists of acids, chiefly hexoic, octoic, decoic, lauric, palmitic, and oleic, and their ethyl esters, about 37 per cent. consisting of esters, the remainder of the free acids.

The dry nuts form 17.5 per cent. of the fruit; they were cracked, and the very hard kernels broken, ground to a meal, and extracted with boiling benzene; in this way, an oil was obtained in amount equal to about 2 per cent. of the fruit. This oil contained about 97.7 per cent. of glycerides of octoic, decoic, lauric, palmitic, stearic, and oleic acids, the rest consisting of the free acids.

The fruit contains in addition about 5.4 per cent. of sugar, estimated by its cupric reducing power, and calculated as invert sugar; also a small amount of pentoses. No alkaloid could be detected.

C. F. B.

Presence of an Oxidising Enzyme in the Vine. By CHARLES CORNU (*J. Pharm.*, 1899, [vi], 10, 342—343).—The vine contains an oxidising enzyme which belongs to the class of "aéroxydases," or enzymes, which only cause oxidation in the presence of air. The activity of the ferment is greater in the spring than in the autumn.

H. R. LÉ S.

Accumulation of Nitrogen by the Cultivation of Intermediate Crops on Loamy Soil. By MAX MAERCKER (*Bied. Centr.*, 1899, 27, 655—656; from *Landw. Jahrb.*, 1898, 27, 157).—A mixture of beans (50), peas (100), and vetches (50 kilos. per hectare) accumulated 154.4 kilos. of nitrogen, whilst as much as 4624 kilos. of organic matter was produced on a hectare. The least favourable results

showed an accumulation of nitrogen corresponding with 5—6 cwt. of sodium nitrate. A mixture of lupins and lathyrus proved to be unsuitable for the soil.

In the dry season of 1898, the effect of the intermediate crop on the succeeding crop of oats was very striking, partly owing to the water supplied by the deep roots of the *Leguminosæ*.

N. H. J. M.

Experiments with Different Lupins. By A. SEMPOLOWSKI (*Bied. Centr.*, 1899, 27, 716; from *Fühling's Landw. Zeit.*, 1898, 47, 517).—The yield of corn (I) in kilos. per hectare, and (II) the percentage of alkaloids, was determined in the following varieties of lupins:—(1) *Lupinus angustifolius*, var. *fl. roseo*; (2) var. *fl. albo*; (3) *L. hirsutus*; (4) var. *fl. cœruleo*; (5) *L. angustifolius*; (6) *L. hirsutus*, var. *fl. albo*; (7) *L. albus*; (8) *L. luteus*, var. *semine nigro*; (9) var. *semine albo*; (10) *L. luteus*; (11) *L. perennis*.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
I.	3321	3310	3236	3154	3088	2924	2708	1736	1717	1550	823
II.	0.430	0.345	0.378	0.378	0.641	0.378	0.250	0.290	0.788	0.833	—

The narrow leaved varieties gave the greatest yields; yellow lupins gave the least, and contained most alkaloids. *L. angust.* var. *fl.*, gave a high yield of corn, with a comparatively low percentage of alkaloids.

N. H. J. M.

[Experiments with] Cows at Lauchstädt, 1896—1897. By FRIEDRICH ALBERT (*Bied. Centr.*, 1899, 27, 663—667; from *Landw. Jahrb.*, 1898, 27, 188. Compare *Abstr.*, 1899, ii, 689).—Experiments were made with 10 cows (two kinds) to ascertain the effect of food-fats on the production of milk and of milk fat. There were five experimental periods of 7—14 days, with longer intermediate periods for gradually changing the foods. The amounts of fat in the concentrated foods were as follows:—Period preceding the experiment (0.504 kilogram); (1) palm cake, 0.937 kilogram of fat; (2) lupins, 0.297; (3) cocoa nut cake, 0.747; (4) cocoa nut cake, (1.706); (5) lupins, 0.297 kilogram of fat.

Increasing the amount of fat in the food had no effect on milk production so long as the amount of fat did not exceed 1 per thousand of the live weight of the cows; with 1.706 kilograms of fat to 1000 kilograms of live weight the production of milk was considerably diminished.

Palm cake and cocoa nut cake increased the percentage of fat in the milk; with the largest amount of fat, the average increase was 0.75 per cent.; with rations (1) and (3) the percentage increase of fat in milk was 0.36 and 0.28.

The rations with low percentage of fat had very little effect on the percentage of fat in the milk, and the lupins affected the taste of the milk.

Feeding with large amounts of fat increased the live weight of the cows considerably; in the case of one breed, the cows became unwieldy and had to be killed. The rations with low percentage of fat caused great loss of weight,

N. H. J. M.

Experiments on Feeding Cows with Brewery Residues. By EBERH. RAMM and E. MÖLLER (*Bied. Centr.*, 1899, 27, 668—670; from *Milchzeit.*, 1899, 97).—The food contains brewery refuse and other materials, and consists of brown, worm-shaped lumps as hard as glass. It contains 42·48 per cent. of digestible proteids, 0·8 per cent. of fat, 26·96 per cent. of non-nitrogenous extract, and 1·3 per cent. of woody fibre.

Feeding experiments were made in which the cows received hay (14), straw (4·5), roots (50), and dried brewers' grains (4 kilograms for 1000 kilograms of live weight). In addition, they received either earth-nut cake (containing 6·5 per cent. of fat), or brewery residues (6 kilograms). After 14 days, the cows which had brewery residues weighed rather more than the others (average 1·97 kilograms), and had yielded 94 grams more milk but 33 grams less fat and 45 grams less dry matter in the milk per head per day. The percentage of fat in the milk was: with earth-nut cake 3·322, and with brewery residues 3·062. The butter, after feeding with (1) earth-nut cake and (2) brewery residues, contained: water, 27·7 and 16·0; fat, 70·91 and 82·10; casein, &c., 1·22 and 1·76; ash, 0·17 and 0·14 per cent. The examination of the fat showed the butter in both cases to be normal.

N. H. J. M.

Amounts of Plant Food withdrawn from Peaty and Sandy Soil by cutting Heather and Turf. By HEINRICH IMMENDORFF (*Bied. Centr.*, 1899, 27, 649—652; from *Landw. Jahrb.*, 1898, 27, iv, 503).—In order to ascertain the losses which moor-land undergoes where turf and heather are cut for litter, samples were taken from measured areas, both from peaty and sandy soil, the ordinary implements being employed. Determinations of the different constituents were then made. The results calculated to kilograms per hectare are as follows: (1) sandy soil, and (2) peaty soil:

Fresh substance.	Dry matter.	N.	K ₂ O.	CaO.	MgO.	Fe ₂ O ₃ . Al ₂ O ₃ .	P ₂ O ₅ .	SO ₂ .
32,500	20,858	179·7	53·4	72·7	31·0	64·6	22·4	40·4
48,750	21,231	201·5	34·0	89·2	40·3	78·6	19·1	53·1

The dry substance removed from the sandy soil consisted of vegetable matter (18,222) and humous sand (2636 kilograms).

Assuming the cutting to take place about every 15 years, it is seen that the land must be impoverished in a comparatively short time, and it is concluded that the benefits resulting from the practice by no means compensate for the injury done to the land.

N. H. J. M.

Amount of Humus in Soils, and the Percentage of Nitrogen in the Humus, as affected by the Application of Air-slaked Lime and other Substances. By HOMER J. WHEELER, C. L. SARGENT, and B. L. HARTWELL (*J. Amer. Chem. Soc.*, 1899, 21, 1032—1037).—Zinc vessels, with holes for drainage, were filled with soil, (254 lbs.), to which different manures were added. Maize was grown the first year, oats the second, and rye the third year. At the end of the experiment, humus, and nitrogen in the humus, were

determined. Nitrogen, as ammonia or nitrate, was applied to some pots at the rate of 2.65 grams per pot, lime at the rate of 4 tons per acre (147.2 grams per pot), and gypsum in amounts corresponding with the lime. All the manured pots had potassium chloride and dissolved bone black.

The percentage amounts of (1) humus nitrogen, and (2) humus in the dry soil, and (3) nitrogen in dry humus, were as follows :

No	Am ₂ SO ₄	Am ₂ SO ₄	Am ₂ SO ₄	No N or	NaNO ₃	NaNO ₃	NaNO ₃	NaNO ₃
manure.	Am ₂ SO ₄	CaO.	CaO.	CaSO ₄	CaO.	CaO.	NaNO ₃	CaO.
1. 0.130	0.128	0.133	0.126	0.139	0.129	0.139	0.143	0.133
2. 3.86	3.93	3.77	3.63	3.65	3.75	3.51	3.93	3.42
3. 3.37	3.26	3.53	3.47	3.81	3.44	3.68	3.64	3.89

The results in the third column were obtained with 36.8 grams of CaO instead of 147.2 grams.

Potassium chloride and phosphoric acid alone (column 6) slightly decreased the humus and humus nitrogen. Lime and gypsum lowered the humus, but increased the nitrogen in the humus. Ammonium sulphate, without lime, reduced the nitrogen in the humus, whilst nitrate increased it.

It would seem that lime increased the amount of humus nitrogen, notwithstanding that the lime pots had yielded the heaviest crops. Although there was also a decrease in the amount of humus, there is probably no danger of injuring soil by the application of lime, as lime gives rise to greatly increased root production, when the land is laid down to grass for a few years.

It is thought probable that nitrates become converted into soluble organic compounds, probably by the intervention of denitrifying organisms. In presence of lime, as well as nitrate, the increase in humus nitrogen was less than with nitrate alone, owing, perhaps, to the destruction of denitrifying organisms by the lime.

N. H. J. M.

Losses of the Nitrogen of Stable Manure in Covered and Uncovered Stalls. By MAX MAERCKER and W. SCHNEIDEWIND (*Bisd. Centr.*, 1899, 27, 656—657; from *Landw. Jahrb.*, 1898, 27, 215); Conservation of Manure. By W. SCHNEIDEWIND (*ibid.*, 658; from *Landw. Jahrb.*, 1898, 27, 234).—The loss of nitrogen in manure in stalls where animals are fattened was comparatively slight (13.2 per cent.) so long as they remain on it, but rose to 34.8 per cent. when the manure remained for 4 weeks without the animals. Manure should therefore be spread on the fields, or treated with a preservative, as soon as the animals leave the stalls.

The loss of nitrogen in uncovered and covered manure heaps was 37.4 and 36.9 per cent. respectively. The higher result, with covered heaps, is attributed to loss of moisture, greater concentration, and increased temperature. Heaps under cover should be kept moist and compact. Addition of slight excess of 0.5 per cent. sulphuric acid causes production of ammonia compounds from proteids.

In fattening experiments with sheep in stalls, the loss of manure nitrogen was again satisfactory, but the manure lost considerably after the sheep were removed.

As regards preservatives, it was found that marl (30 per cent.) reduced the loss of nitrogen from 22.6 to 9.9 per cent.; with marl (30) and peat litter (2 per cent.), the loss was 6.1 per cent. Sodium hydrogen sulphate (6 per cent.) reduced the loss of nitrogen to 1.3 per cent. and at the same time rather improved the quality of the manure by increasing the nitrogen directly available. N. H. J. M.

Bat Guano found at Cagliari, Sardinia. By GIULIO PARIS (*Chem. Centr.*, 1899, ii, 65; from *Staz. sper. agrar. ital.*, 32, 176—185. Compare *Abstr.*, 1897, ii, 383).—The guano has the following percentage composition:—Moisture, 13.85; organic matter, 58.78; ammonia, 1.32; nitric acid, 0.75; uric acid, 0.63; Na_2O , 3.10; K_2O , 1.77; CaO , 1.72; MgO , 0.48; Fe_2O_3 and Al_2O_3 , 5.20; P_2O_5 (organic, citrate soluble, and insoluble respectively), 0.50, 4.20, and 0.66; SO_3 , 2.28; SiO_2 (soluble and insoluble in HCl , sp. gr. 1.11), 1.17 and 3.65; CO_2 , 1.80. N. H. J. M.

Value of Lime Compounds in Phosphatic Manures. By O. BÖTTCHER (*Bied. Centr.*, 1899, 27, 662—663; from *D. Landw. Presse*, 1899, 91, 222).—In reply to Ullmann (*ibid.*, No. 13), it is stated that the value of basic slag as a lime manure is not less at the present time than formerly; the amount of free lime is usually only slightly less.

Citric acid (2 per cent.) dissolved, in half an hour, 42—45 per cent. of lime; and in 12 hours, 45—52 per cent. N. H. J. M.

Analytical Chemistry.

Estimation of Oxygen in Water. By L. MUTSCHLER (*Chem. Centr.*, 1899, ii, 225; from *Zeit. Unters. Nahr.-Genussm.*, 2, 481).—The method consists in enclosing in a bottle of about a litre capacity three sealed glass tubes, one of which contains an alkali, the second a known volume of $N/10$ ferrous ammonium sulphate, and the third an excess of 50 per cent. sulphuric acid. The acid tube is attached to the caoutchouc stopper, the others lie at the bottom. After filling the bottle with the water, the two former are fractured by a glass ball and the ferrous hydroxide diffused through the water. After a sufficient time, the acid tube is also fractured and the unoxidised ferrous salt titrated with $N/10$ permanganate. M. J. S.

Estimation of Sulphur in Pig Iron. By M. J. MOORE (*J. Amer. Chem. Soc.*, 1899, 21, 972—975).—In the estimation of sulphur in pig iron, much less sulphur is always obtained by the volumetric process than by the gravimetric method.

The practice of pouring the molten metal into water and obtaining a "shot sample" is not a good one; it is preferable to catch a small test in a sand mould. L. DE K.

Estimation of Sulphur in Petroleum. By SIEGFRIED FRIEDLÄNDER (*Chem. Centr.*, 1899, ii, 406—407; from *Arbb. Kais. Ges.-A.*, 15, 365—372).—The sample is burnt in an Ohlmüller lamp, which is weighed before and after the experiment, the products of combustion being drawn through two wash-bottles containing a 5 per cent. solution of potassium hydrogen carbonate. The solution is then oxidised by means of potassium permanganate and hydrochloric acid, and the sulphuric acid estimated as usual.

L. DE K.

Estimation of Sulphur in Petroleum. By SIEGFRIED FRIEDLÄNDER (*Chem. Centr.*, 1899, ii, 629—630; from *Chem. Ind.*, 22, 343—349).—Equally good results are obtained by the use of the apparatus and processes of Heusler, Engler, Kiessling, or Ohlmüller, but the latter is by far the quickest, it being possible to effect an analysis in half an hour. Attention is called to the occasional presence of sulphur compounds in the air, and to the means for removing them.

L. DE K.

Estimation of Sulphur in Naphtha. By ALEXANDER P. LIDOFF (*Chem. Centr.*, 1899, ii, 493; from *J. Russ. Chem. Soc.*, 1899, 31, 567—570).—1 gram of the sample is dissolved in ether and carefully mixed with 30 grams of a mixture of 17 parts of potassium nitrate and 13 parts of sodium carbonate. When the ether has completely evaporated, the mixture is put by small degrees into a platinum dish heated to redness. The fused mass contains the sulphur as sulphate, which is then estimated in the usual way.

L. DE K.

Estimation of Sulphur in Organic Substances. By ROBERT HENRIQUES (*Chem. Zeit.*, 1899, 23, 869).—The process recommended for the estimation of total sulphur in rubber wares may be safely used for the analysis of other not readily volatile organic substances (compare this vol., ii, 123).

L. DE K.

Detection of Nitrogen in Organic Compounds containing Sulphur. By ERNST TAUBER (*Ber.*, 1899, 32, 3150—3154).—Jacobsen's method (*Ber.*, 12, 2318) which consists in adding iron-powder to the substance before heating with potassium, is entirely untrustworthy, since the addition of the iron greatly facilitates the absorption of nitrogen from the air, and cyanides are formed even when the substance contains no nitrogen; the method is useless unless carried out in a stream of hydrogen. Magnesium has a similar, but very slight, effect in facilitating the absorption of nitrogen; tungsten, chromium, and nickel are still less effective, and copper produces no effect at all. The method recommended consists in using a large excess of potassium and then an excess of ferric chloride to oxidise the potassium sulphide which is formed.

T. M. L.

NOTE.—The inaccuracy of Jacobsen's method was pointed out at the time by Remsen (*Abstr.*, 1880, 473).—EDITORS.

New Method for Estimating Nitric Acid. By J. F. POOL (*Chem. Centr.*, 1899, ii, 227; from *Nederl. Tijdschr. Pharm.*, 11, 171).—The nitrate is evaporated to dryness with excess of sodium chloride

in a flask. The air is expelled by carbon dioxide, and concentrated sulphuric acid is introduced; water is added and the gases are driven over by boiling into a solution of potassium iodide. The liberated iodine is then titrated. M. J. S.

Estimation of Phosphorus by Reed's Method. By D. GERHARDT (*Chem. Centr.*, 1899, ii, 227; from *Nederl. Tijdschr. Pharm.*, 11, 174).—Reed's method (Abstr., 1899, ii, 451) depends on the fact that phosphorus dissolved in carbon disulphide combines with 5 atoms of bromine in presence of alcohol. The author finds that the presence of alcohol is not necessary; in a simple carbon disulphide solution 5 atoms of bromine are absorbed, not 3, as stated by Reed. The method is useless in presence of fats. M. J. S.

Estimation of Phosphorus in Organic Compounds. By CH. MARIE (*Compt. rend.*, 1899, 129, 766—767).—The substance is oxidised by nitric acid and potassium permanganate, the phosphoric acid precipitated with ammonium molybdate, the precipitate washed until quite free from manganese, redissolved in ammonia, and precipitated with magnesia mixture. The ammonium magnesium phosphate should be washed until the filtrate gives no coloration when treated with excess of hydrochloric acid, a small quantity of ammonium thiocyanate, and a fragment of zinc.

15 to 20 c.c. of concentrated nitric acid are used for each gram of substance, heated on a water-bath, and from 5 to 6 grams of finely powdered potassium permanganate are added in successive small portions until the liquid remains red for several minutes. Excess of permanganate is decomposed by adding a small quantity of sodium or potassium nitrite. Even compounds difficult to oxidise by Carius' method are readily dealt with in this way. C. H. B.

Separation of Barium, Strontium, and Calcium by Mixed Carbonate and Sulphate Solutions of varying Composition. By FRIEDRICH W. KÜSTER (*Zeit. anorg. Chem.*, 1899, 22, 161).—A short criticism of Morgan's theoretical calculations (Abstr., 1899, ii, 627). The author points out that in the calculation of the solubility product, Morgan has entirely neglected the effect of the hydrolysis on the barium carbonate solution. E. C. R.

Composition of Ammonium Magnesium Phosphate. By HUGO NEUBAUER (*Zeit. anorg. Chem.*, 1899, 22, 162), and by FRANK A. GOOCH and MARTHA AUSTIN (*ibid.*, 163).—Neubauer claims priority in determining the composition of the magnesium ammonium phosphate precipitated in the usual method of estimation, and Gooch and Austin admit the justness of his claim (compare Neubauer, Abstr., 1893, ii, 236, 489; 1896, ii, 73, 674). E. C. R.

Analysis of "Weissmetall." By H. NISSENSON (*Chem. Zeit.*, 1899, 23, 868—869).—This alloy consists chiefly of lead with tin and antimony. It is dissolved in dilute nitric acid containing tartaric acid, sulphuric acid added, and the nitric acid expelled by heat, taking care not to char the tartaric acid. It is then diluted with water and the undissolved lead sulphate collected, the filtrate rendered alkaline

with aqueous caustic soda, excess of sodium sulphide added, and the whole boiled and filtered from any copper sulphide. The liquid is then electrolysed at 80°, using a current of 3 volts and 1.5 amperes, when the antimony is deposited. To obtain the tin, sufficient ammonium sulphate is added to convert all the sodium sulphide into the ammonium compound and the liquid again electrolysed. L. DE K.

Electrolysis of Metallic Phosphate Solutions. By HARRY M. FERNBERGER and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1899, 21, 1001—1007).—The best conditions for the separation of copper from iron, aluminium, chromium, cobalt, zinc, nickel, or manganese in phosphoric acid solution have been determined.

In every case, a solution containing a little over 0.1 gram of each metal was employed, the phosphate was precipitated by adding 30—60 c.c. of disodium hydrogen phosphate solution of sp. gr. 1.0358, then dissolved by adding 5—10 c.c. of phosphoric acid solution of sp. gr. 1.347, and the solution electrolysed with a normal current density of from 0.035—0.072 ampere and a voltage of 1.5—2.6. In each case, the amount of liquid was 225 c.c., the time occupied 5 to 7 hours, and the temperature was kept at 60—70°.

Nickel may also be deposited from phosphoric acid solution by employing a current of 0.5 ampere and 7—8 volts. It has been found impossible to completely separate nickel from manganese, chromium, or zinc, mercury from cadmium or uranium, and copper from uranium. Mercury may, however, be separated from zinc. J. J. S.

Analysis of Bronzes. By A. FOMIN (*Chem. Centr.*, 1899, ii, 495—496; from *J. Russ. Chem. Soc.*, 31, 565—567).—About 0.3 gram of bronze filings, freed from iron particles by aid of a magnet, is treated with nitric acid. Ammonium nitrate is added and the whole evaporated to dryness. The residue is treated with water, neutralised with ammonia, and again acidified with nitric acid, and the insoluble matter, consisting of tin oxide slightly contaminated with antimony, iron, and traces of copper, is removed by filtration.

The filtrate, measuring about 100 c.c., is mixed with 30 drops of nitric acid and submitted to electrolysis by means of a current of 0.14—0.34 ampere and 2 volts. After 3—4 hours, 5 c.c. of saturated solution of ammonium nitrate are added, and in 24 hours the operation is finished. The electrodes are washed twice with water and once with alcohol. The one with the copper deposit is dried quickly, and the other, coated with lead dioxide, is dried for 15 minutes at 180°. Iron is then searched for in the usual way. L. DE K.

Estimation of Manganic Acids in the presence of Manganese Salts or of both Manganese Compounds in the presence of each other, by means of an Alkaline Solution of Arsenious Acid. By C. REICHARD (*Chem. Zeit.*, 1899, 23, 867—868).—Aqueous sodium hydroxide is added in sufficient quantity to precipitate the manganese salts as manganous or manganic hydroxide. Standardised alkaline solution of arsenious acid is then added and the operation is conducted as previously described (*Abstr.*, 1899, ii, 813).

The residue left on the filter is then ignited and weighed; the difference in the total manganese and that found by titration represents the manganese salts.

Two other processes are also suggested, but not supported by experiments.

L. DE K.

Estimation of Chromium in Iron and Steel. By E. DÖHLER (*Chem. Zeit.*, 1899, 23, 868).—The sample is dissolved in hydrochloric acid, and from this solution the chromium is precipitated by repeated treatment with excess of barium carbonate in a closed flask. The precipitate is then fused in a porcelain crucible with potassium nitrate and potassium sodium carbonate, and the chromium estimated in the aqueous extract in the usual manner.

L. DE K.

Estimation of Chromium in Steel. By R. W. MAHON (*J. Amer. Chem. Soc.*, 1899, 21, 1057—1060).—This is a slight modification of McKenna's process based on the oxidation of chromium to chromic acid by means of nitric acid and potassium chlorate, and titration with ferrous sulphate and potassium permanganate.

Nitric acid and potassium chlorate are employed in greatly reduced quantities, and paper instead of asbestos is used as a filtering medium.

L. DE K.

Detection of Alkali Chromates in Milk. By ALEXANDRE LEYS (*J. Pharm.*, 1899, [vi], 10, 337—340).—The white ash obtained by the evaporation and subsequent ignition of 100—150 c.c. of the milk is moistened with distilled water and filtered. A portion of this filtrate is added to 5 c.c. of pure concentrated hydrochloric acid, previously coloured with indigo-carmin, when, if a chromate is present, the solution will be immediately decolorised. A second portion of the filtrate is added to 5 c.c. of an acetic acid solution of pure aniline and commercial toluidine, when, if a chromate is present, a cherry-red coloration, due to magenta, will be produced on heating. These reactions only prove the presence of an oxidising substance, and in order to further identify the chromate, the rest of the filtrate is acidified with dilute sulphuric acid and a few drops of a solution of hydrogen peroxide added, when the production of a blue coloration fully proves the presence of a chromate.

H. R. LE S.

Iodometric Estimation of Gold. By FRANK A. GOOCH and FREDERICK H. MORLEY (*Amer. J. Sci.*, 1899, 8, 261—266).—Contrary to Peterson's statement that gold chloride cannot be estimated by the iodine set free when it is treated with potassium iodide, the authors have found this to be a very accurate method for the estimation of very small quantities of gold.

The gold, which should be in the metallic state and not exceed 0.01 gram, is dissolved in chlorine water, and the excess of chlorine is then removed by adding ammonia, boiling and acidifying with hydrochloric acid; this treatment should be repeated. After diluting to 200 c.c., 10 c.c. of the liquid are mixed with 0.02 gram of potassium iodide, and the liberated iodine then found by titrating with *N*/1000 solution of sodium thiosulphate, using starch as indicator; it is advisable

to add a very slight excess and then to titrate back with *N/1000* solution of iodine.

L. DE K.

Parting of Gold Platinum Alloy. By EDUARD PŘIWOZNIK (*Chem. Centr.*, 1899, ii, 539; from *Oesterr. Zeit. Berg.-Hütt.*, 47, 356—358).—The following process is used in the imperial Austrian assay office. The alloy is first treated with nitric acid of sp. gr. 1.199, which also dissolves a little of the platinum if silver is present. The mass is then treated with diluted *aqua regia* (100 c.c. of strong hydrochloric acid, 43 c.c. of strong nitric acid, and 143 c.c. of water), which dissolves the gold with moderate ease, but does not perceptibly attack the platinum. If there should be any silver left, the metal gets coated with silver chloride and the gold is prevented from dissolving; in that case, the liquid is poured off and the silver chloride removed by means of ammonia. The gold solution is heated with hydrochloric acid until the nitric acid is expelled, and the platinum then precipitated with excess of ammonium chloride.

If the alloy is composed of gold, silver, and platinum, each in large proportion, it must be fused with thrice its weight of zinc; after treating with sulphuric acid, the undissolved mass is treated as just directed.

L. DE K.

Method and Apparatus for Incinerating Vegetable and Animal Substances. By A. E. SHUTTLEWORTH and BERNHARD TOLLENS (*Chem. Centr.*, 1899, ii, 144; from *Jahrb. Landw.*, 47, 173).—Addition of calcium acetate prevents the sintering which so often forms an obstacle to complete incineration. The authors have devised a special platinum apparatus (not described) by the use of which the time necessary for incineration is much shortened, and volatilisation of chlorides is prevented.

M. J. S.

Tucker (this vol., ii, 52) has described a modified form of this apparatus.—EDITORS.

Application of the Kjeldahl Method of Destroying Organic Substances in the Detection of Metals. By OTTO GRAS and WILHELM GINTL, jun. (*Chem. Centr.*, 1899, ii, 145; from *Oesterr. Chem. Zeit.*, 2, 308).—Halenke's process (*Abstr.*, 1899, ii, 696) is especially suitable for the examination of coal-tar dyes. 10 grams of the substance is heated for 6—8 hours with 60—80 c.c. of sulphuric acid containing 10 per cent. of potassium sulphate, with final addition of some potassium nitrate. After diluting and warming, the solution is ready to be examined for metals.

M. J. S.

Estimation of Ferrocyanides in Spent Gas-purifying Material. By RUDOLF RIECHELMANN (*Chem. Centr.*, 1899, ii, 144; from *Zeit. öffentl. Chem.*, 5, 188).—The methods of Donath and Margosches (*Abstr.*, 1899, ii, 527) and that of Knublauch (*Abstr.*, 1890, 87) do not yield concordant results, since the former expresses as ferrocyanogen the iron soluble in other forms in the alkaline solution.

M. J. S.

Improvement in Trillat's Process for the Detection of Methyl Alcohol in Alcohols. By JULES WOLFF (*Chem. Centr.*, 1899, ii, 229—230; from *Ann. chim. anal. appl.*, 4, 183).—Pure ethyl

alcohol when treated by Trillat's process (Abstr., 1899, ii, 130) yields a condensation product which gives an identical reaction with that from methyl alcohol, but the former is not produced at atmospheric temperatures or below 60°. The following modification is therefore proposed: 100 c.c. of the alcohol is distilled; the first 10 c.c. are mixed with a solution of 15 grams of potassium dichromate in 130 c.c. of water and 70 c.c. of sulphuric acid (1:5); after 20 minutes, the mixture is distilled, the first 25 c.c. are rejected, and 50 c.c. from the following 100 c.c. are mixed with 1 c.c. of dimethylaniline and left at the ordinary temperature for 24 hours. After adding a little phenolphthalein, the liquid is accurately neutralised with soda and 30 c.c. distilled from it. To the residue there are added 25 c.c. of water and 1 c.c. of acetic acid, and the colour produced by lead peroxide is observed.

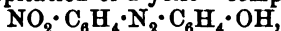
M. J. S.

Estimation of Alcohol in the Blood and Tissues. By NESTOR GRÉHANT (*Compt. rend.*, 1899, 129, 746—748).—See this vol., ii, 95.

Bromination of Phenols.—By WILHELM VAUBEL (*Zeit. angew. Chem.*, 1899, 1031—1032. Compare Abstr., 1893, i, 560; 1894, i, 19, 453; 1895, i, 55; 1896, i, 147, ii, 507).—A reply to Ditz and Cedivoda (this vol., ii, 54).—The author claims that good results are obtained by his method when a large excess of acid is present during the bromination and titration.

J. J. S.

Estimation of Carboic Acid and other Phenols. By E. RIEGLER (*Chem. Centr.*, 1899, ii, 322; from *Bull. soc. sci. Bucuresci*, 8, 51—53).—50 c.c. of the aqueous solution, containing not more than 0.1 gram of the phenol, are mixed with 10 c.c. of a 5 per cent. solution of sodium hydroxide and 20 c.c. of diazo-solution. The red solution is now gradually acidified with dilute sulphuric acid (1:5), which causes the precipitation of a yellow compound,



which is washed, dried at 100°, and weighed; it is practically insoluble in water, 100 c.c. only dissolving 0.0002 gram.

The diazo-solution is prepared by mixing 5 grams of *p*-nitraniline, 25 c.c. of water, and 6 c.c. of sulphuric acid; 100 c.c. of water and 3 grams of sodium nitrite dissolved in 25 c.c. of water are then added, and the whole diluted to 200 c.c. The reagent must be kept in a dark place.

L. DE K.

New Method for the Gravimetric Estimation of Sugars. By PH. CHAPELLE (*J. Pharm.*, 1899, [vi], 10, 395—398).—The sugar solution and 25 c.c. of Fehling's solution are placed in the tube of a centrifugal machine, diluted to 37.5 c.c., and heated in a calcium chloride bath at 110° for 6 minutes, in the case of dextrose solutions, and 10 minutes for lactose solutions. The whole is then whirled in the centrifuge for 3—4 minutes, and the liquid poured off from the precipitate, which adheres firmly to the sides of the tube. Boiling water is then added, and the whole again whirled. The water is then poured off, the tube and precipitate rapidly dried at 150—180° for 5 minutes and weighed. The method is rapid, and is applicable to the estimation of sugar in milk, urine, or gastric juice, from which

the proteids have been previously removed. The method is also applicable to the estimation of sugar by means of Sachsse's solution.

H. R. LE S.

Influence of Lead Acetate and Basic Acetate on the Estimation of Reducing Sugars in Wines and Lees. By HENRI PELLET (*Chem. Centr.*, 1899, ii, 573—574; from *Ann. chim. anal. appl.*, 4, 256—257).—Normal lead acetate is recommended in place of the basic salt in clarifying wines for polarisation, as the latter precipitates some of the sugar and so causes low results.

L. DE K.

Estimation of Sugar in Urine. By HENRI PELLET (*Chem. Centr.*, 1899, ii, 574; from *Ann. chim. anal. appl.*, 4, 256—257).—When preparing urine for polariscopic purposes, it is best to clarify with normal lead acetate or mercuric nitrate.

When using basic lead acetate, there is a danger that loss of sugar may occur, especially if the urine is neutral or alkaline.

L. DE K.

Estimation of Invert Sugar in the Presence of Sucrose. By H. JESSEN-HANSEN (*Chem. Centr.*, 1899, ii, 574; from *Compt. rend. trav. Lab. Carlsberg*, 1899, 103).—By operating as follows, the reduction of the alkaline copper solution by sucrose is reduced to a minimum: 10.4 grams of potassium sodium tartrate are dissolved in 15 c.c. of Kjeldahl's aqueous caustic soda, 15 c.c. of copper solution are added, and then the saccharine liquid; the whole is heated for 5 minutes on the boiling water-bath, a current of hydrogen being transmitted meanwhile.

L. DE K.

Estimation of Starch in Yeast. By GUSTAVE BRUYLANTS and H. DEUYTS (*Chem. Centr.*, 1899, ii, 154—155; from *Bull. assoc. Bely. Chim.*, 1899, 20).—The yeast is diffused in water, and the starch iodised by addition of a solution of iodine in potassium iodide. Its specific gravity is thereby increased and its tendency to ferment diminished. Any cell-residues are removed by passing the liquid through a silk sieve, and the mixture is allowed to deposit in a cylindrical glass vessel. As soon as the blue sediment becomes covered with a thin layer of yeast, the upper liquor is decanted and water added. The washing is continued until the microscope shows only traces of yeast. Hydrochloric acid is then added until the liquid contains 2 per cent. of acid, the mixture is heated until the starch dissolves and a small quantity of potassium sulphite added.

M. J. S.

Estimation of Glycogen. By ARMAND GAUTIER (*Compt. rend.*, 1899, 129, 701—705. Compare this vol., i, 81).

Detection of Acetic Acid in Urine. By V. ARNOLD (*Chem. Centr.*, 1899, ii, 146—147; from *Wien. Klin. Woch.*, 12, 541).—1 gram of *p*-aminoacetophenone is dissolved in 80—100 c.c. of water with addition of hydrochloric acid; a 1 per cent. solution of sodium nitrite is also required. 2 vols. of the former solution and 1 vol. of the latter are mixed, and 3 vols. of urine are added with 2—3 drops of strong ammonia. All urines give a more or less intense brownish-red coloration, which, on addition of 10—12 vols. of concentrated hydro-

chloric acid, passes into purple violet if acetic acid is present, but otherwise into yellow. Dark coloured urines are first decolorised by animal charcoal.

For the detection of bilirubin, an excess of aniline-*p*-sulphonic acid is added to 1 per cent. hydrochloric acid; then to 4 c.c. of this liquid, mixed with 0.5—1 c.c. of a 5 per cent. sodium nitrite solution and 50 c.c. of water, there is added $\frac{1}{2}$ —1 vol. of the urine. In presence of bile colouring matters, the mixture becomes orange-red, and on addition of a few drops of strong hydrochloric acid, violet. *p*-Diazobenzenesulphonic acid, which, as well as *p*-aminoacetophenone, can be employed for the detection of ethyl acetate in ether, does not give so marked a reaction with free acetic acid. M. J. S.

Estimation of the Insoluble Fatty Acids in Butter, and the Cause of Differences in the Results. By V. MAINSBRECK (*Chem. Centr.*, 1899, ii, 154; from *Rev. intern. falsific.*, 12, 87).—The want of agreement in the results obtained by different analysts in the estimation of the *Hehner* value appears to be due to differences in the time of heating and the amount of washing. From the author's experiments the loss amounts to 0.7 per cent. for each one and a half hours boiling. Litmus paper is not sufficiently sensitive for ascertaining the point of complete washing. In one experiment, 0.6 per cent. was removed by washing, and titration of the washings with *N*/10 alkali and phenolphthalein proved the continuous removal of soluble acids, after litmus ceased to show any acid reaction. It is therefore recommended that there should be a general agreement respecting the time of heating, and that the washing should be continued until 100 c.c. (with phenolphthalein) requires only 0.2 c.c. of *N*/10 alkali. M. J. S.

Estimation of Succinic Acid in Fermented Liquids. By J. LABORDE and L. MOREAU (*Ann. de l'Inst. Pasteur*, 1899, 13, 657—664).—When a solution containing succinic acid and glycerol is evaporated on the water-bath, a part of the succinic acid is converted into its glyceryl ester. This accounts for the low results obtained in the estimation of succinic acid in wines or other fermented liquids which invariably contain glycerol. This difficulty may be overcome thus: the succinic acid separated from the liquid is first titrated with decinormal alkali, and then the esters are hydrolysed by a known volume of decinormal alkali, and when the hydrolysis is complete the excess of alkali is titrated with decinormal acid. Only a small part of the succinic acid present in fermented liquids exists in the free state, the greater portion being present as a salt, from which the whole of the acid may be liberated by the addition of tartaric acid or potassium hydrogen sulphate. Tartaric acid is, however, slightly soluble in ether, and the amount dissolved by the ether must consequently be determined. This is done by converting the neutral tartrate into the acid tartrate by adding acetic acid and alcohol to the liquid which has been titrated, evaporating to dryness, and estimating the acid tartrate thus formed by titrating with decinormal alkali.

If the fermented liquid, in which succinic acid is to be estimated, contains more than 1 per cent. of sugar, it is evaporated to a syrup, 10 to 20 c.c. of alcohol are added, and the succinic acid separated by repeated extraction with ether. H. R. LE S.

Colour Reaction for Tartaric Acid and its Compounds. By JULES WOLFF (*Chem. Centr.*, 1899, ii, 569; from *Ann. chim. anal. appl.*, 4, 263).—Attention is called to a forgotten test for tartaric acid. A few centigrams of resorcinol are heated in a porcelain capsule with a little sulphuric acid until fumes are given off and the tartrate is added, when an intense dark red coloration is obtained. Neither oxalic nor citric acid gives the reaction. L. DE K.

Detection of Urochloralic Acid in Urine after Administration of Chloral Hydrate, especially in Cases of Poisoning. By DIOSCORIDE VITALI (*Chem. Centr.*, 1899, ii, 147; from *Boll. Chim. Farm.*, 1899, 38, 377).—The urine is concentrated to half its volume, and treated with a small excess of lead acetate and ammonia to feeble alkaline reaction. The precipitate of lead urochloralate is washed, then warmed with dilute sulphuric acid, and the filtrate cohobated for half an hour with zinc powder and sulphuric acid. The trichloroethyl alcohol resulting from the hydrolysis of urochloralic acid is thereby reduced to ethyl alcohol, which, after removal of the zinc by sodium carbonate, can be distilled over lime and recognised by odour, inflammability, conversion into iodoform, and into acetaldehyde (which may further be confirmed by Rimini's reaction), and by Vitali's reaction (treatment with carbon disulphide, potash, ammonium molybdate, and excess of dilute sulphuric acid, which produce the red colour of molybdenum xanthate). M. J. S.

Modified Soxhlet Apparatus for the Extraction of Fats from Liquids. By ALONZO ENGLEBERT TAYLOR (*Amer. J. Physiol.*, 1899, 3, 183—185).—The apparatus, which is figured and fully described, is stated to extract fat from solutions much more effectively than the Soxhlet apparatus, or the modifications of that instrument which have been hitherto devised. W. D. H.

Butter and Butter Substitutes. By W. G. INDEMANS (*Chem. Centr.*, 1899, ii, 495; from *Ned. Tijds. Pharm.*, 11, 219—226).—The chief points in butter analysis are, *A*, The number of molecules in a definite quantity of fat. *B*, The amount of olein. *C*, The solubility of the fatty acids in water.

The density, the electric resistance, the saponification number, the refractometer number, and the critical temperature of solution depend on *A*; the Hübl and Asboth's numbers depend on *B*; the melting and solidifying points depend on *A* and *B*, and the Reichert-Meissl and the Hehner-Angell numbers depend on *C*. As regards the number of molecules and the small amount of olein, butter-fat is surpassed by Ceylon oil, as it is also in density, electric resistance, and refractometer indication. The chief point of difference of butter from its surrogates, however, consists in the high percentage of fatty acids soluble in water and of the volatile acids; the latter vary with the season. L. DE K.

Rancidity in Butter-fat. By C. A. BROWNE, jun. (*J. Amer. Chem. Soc.*, 1899, 21, 975—994).—The so-called rancidity of fats is a much more complex phenomenon than hitherto believed.

As the rancidity of butter-fat increases, a decided increase in the acid, saponification, and Reichert numbers takes place; also a slight

increase in the ether number and a very marked decrease in the iodine absorption. Finally, an increase is noticed in the acetyl number and a decrease in the percentage of soluble acids and glycerol.

The physical constants of butter-fat, such as the specific gravity, refractive index, and heat of combustion, are also affected by rancidity.

L. DE K.

The Becchi Test. By ALPH. VAN ENGELN (*Chem. Centr.*, 1899, ii, 147—148; from *Rev. intern. falsific.*, 12, 90).—Several variations in the mode of applying this test are in use. The author shows that in applying it to the free fatty acids (Millieau's method) the presence of small quantities of free mineral acid is prejudicial; the fatty acids must therefore be thoroughly washed with hot water, and the form of the test in which the reagent is acidified with nitric acid should be abandoned. To ascertain whether cotton-seed oil could be detected in the butter of cows fed with cotton-seed cake, two reagents were employed. The first consisted of 1 gram of silver nitrate dissolved in the smallest quantity of water and mixed with 200 c.c. of absolute alcohol; the second, of a solution of 1 gram of silver nitrate, 250 c.c. of 98 per cent. alcohol, 40 c.c. of ether, and 0.2 c.c. of nitric acid. The fat was dissolved in an equal volume of amyl alcohol, mixed with 1 c.c. of the reagent, and heated in the water-bath for 15 minutes. With the first reagent, the butter gave a coffee-brown, with the second a lemon-yellow, coloration. These reactions, and others obtained with the fatty acids, are not regarded as decisive of the question.

M. J. S.

Becchi's Test for Cotton-seed Oil. By PAUL SOLTSIEN (*Chem. Centr.*, 1899, ii, 539; from *Zeit. öffentl. Chem.*, 5, 306—308).—The Becchi silver reduction reaction is chiefly due to the presence of sulphur, this occurring in decided amount in samples of cotton oil which have been extracted from the seed by means of light petroleum; oil obtained by pressure contains but a trace of sulphur, and it loses this on heating at 200°.

In the original Becchi test, it was recommended that some rape oil should be added to intensify the reaction; this must, however, previously be heated at 150° to desulphurise it.

L. DE K.

Baudouin's Reaction. By WILHELM KERP (*Chem. Centr.*, 1899, ii, 228—229; from *Zeit. Unters. Nahr.-Genussm.*, 2, 473).—Commercial furfuraldehyde requires to be purified by two distillations under reduced pressure; a dilute alcoholic solution keeps well in completely filled bottles in the dark. The production of a violet coloration with hydrochloric acid alone depends both on the strength of the furfuraldehyde solution and on the amount of acid added. When the solution is sufficiently dilute and the quantity of acid small enough, the violet colour is not produced immediately, whilst the sesamé oil reaction is both more rapid and more sensitive. The concentration of the acid is also of importance. Acid of sp. gr. 1.127 gives the Baudouin reaction, but produces no violet colour in the absence of sesamé oil; a stronger acid (1.16) may be used in doubtful cases. Heating must be avoided. The lower limit of the reaction is at a dilution of 0.2 per cent. of

sesamé oil : it follows that 2—2.5 grams of the oil can be detected in a kilogram of butter. The method cannot, however, be used as a quantitative colorimetric one. The behaviour of the red substance with various solvents is described, and some notes on its absorption spectrum are given. M. J. S.

Colour Tests for Sesamé Oil: Three New Characteristic Tests. By J. BELLIER (*Chem. Centr.*, 1899, ii, 453—454; from *Ann. chim. anal. appl.*, 4, 217—220).—The known tests are criticised. Behrens' reagent, a mixture of equal parts of sulphuric and nitric acids, is said to give better results if made of 100 c.c. of sulphuric acid, 10 c.c. of nitric acid, and 50 c.c. of water.

As new tests are proposed: *Ammonium vanadate*.—100 c.c. of sulphuric acid, 50 c.c. of water, and 2 grams of ammonium vanadate; this, on shaking with sesamé oil, gives a green colour, gradually becoming blackish. *Formaldehyde*.—100 c.c. of sulphuric acid, 50 c.c. of water, and 10 c.c. of 40 per cent. formaldehyde. Equal volumes of this reagent and sesamé oil gives, on shaking, a permanent bluish-black colour; an admixture of 1 per cent. of sesamé oil in olive oil may thus be detected. *Resorcinol*. 2 c.c. of the suspected oil is put into a test-tube, 2 c.c. of a saturated solution of resorcinol in benzene are added, and then 2 c.c. of nitric acid of sp. gr. 1.38 free from nitrogen oxides. In the presence of sesamé oil, an intense violet-blue or greenish-blue coloration is obtained. L. DE K.

Estimation of Formaldehyde in the Air. By M. WINTGEN (*Chem. Centr.*, 1899, ii, 454—455; from *Hygien. Rdsch.*, 9, 753—757).—A controversy with Peereboom on the subject of the estimation of formaldehyde in the air by Romijn's process (*Abstr.*, 1898, ii, 166). With care, this process gives satisfactory results. L. DE K.

Detection of Aldehydes in Alcohols. By CONSTANTIN I. ISTRATI (*Chem. Centr.*, 1899, ii, 148—149; from *Rev. intern. falsific.*, 12, 91).—Barbe and Janvier's method (*Ann. chim. anal. appl.*, 1, 325), as improved by the author, consists in mixing exactly 2 c.c. of the alcohol with 0.2 c.c. of a saturated alcoholic solution of the special reagent, and pouring 1 c.c. of sulphuric acid down the side of the test-tube. The colours produced are observed immediately, then half an hour later with gentle shaking, then after thorough mixing, and, finally, after addition of 10 c.c. of water. The colours produced by such reagents as pyrogallol, α - and β -naphthols, phenylhydrazine, quinol, guaiacol, &c., with various aldehydes are given. M. J. S.

Estimation of Carvone in Volatile Oils. III. By F. W. ALDEN and S. NOLTE (*Pharm. Archives*, 1899, 2, 81—91).—In a 500 c.c. flask, fitted with a reflux condenser, 10 grams of the oil, 25 c.c. of alcohol, 5 grams of hydroxylamine hydrochloride, and 6.5 grams of sodium hydrogen carbonate are boiled together for $\frac{1}{4}$ — $\frac{1}{2}$ hour on the water-bath, only a small surface of the flask being heated; 25 c.c. of water are then added, the alcohol and much of the limonene distilled off on the water-bath, and then steam is passed through, the distillate being collected in fractions of 5—10 c.c. in test-tubes until it is seen to contain crystalline carvoxime. The last fraction and the tube of the

condenser are rinsed back into the flask with hot water; when cold, the solid carboxime is filtered off and drained by aid of a filter pump, and finally dried in the air. Should any oxime separate from the previous fractions of the distillate during the next day or so, it is added to the main quantity. The whole is then heated for an hour in a tared glass dish on the water-bath over an opening 43 mm. in diameter, and weighed; 0.100 gram is added, to correct for loss by volatilisation during the heating, and the sum is multiplied by 0.909, to calculate the equivalent amount of carvone. The error of the method amounts to several units per cent.; the influence on it of various modifications of the conditions of the experiment was investigated. C. F. B.

Examination of Resins. X. Storax. By KARL DIETERICH *Chem. Centr.*, 1899, ii, 541; from *Pharm. Centr.-Halle*, 40, 423—428, 439—443. Compare *Abstr.*, 1898, ii, 58).—When testing storax, it is preferable to work on the crude sample instead of using the alcoholic extract.

To determine the acidity number, 1 gram of the sample is dissolved in 100 c.c. of cold 96 per cent. alcohol, and titrated with $N/2$ alcoholic potash, using phenolphthalein as indicator. The saponification number is found by dissolving 1 gram of the sample in 20 c.c. of $N/2$ alcoholic potash, and 50 c.c. of benzene, and, after 24 hours, titrating the excess of alkali with $N/2$ sulphuric acid. The following figures may be held to indicate the average composition of genuine storax: Water, not over 30 per cent.; ash, not over 1 per cent.; soluble in alcohol, not less than 60 per cent.; insoluble, not more than 3 per cent. Acidity number, 55—75; ether number, 35—75; saponification number, 100—140. L. DE K.

Testing Storax. By FERD. EVERS (*Chem. Centr.*, 1899, ii, 594; from *Pharm. Zeit.*, 44, 592—593).—The author objects to Dieterich's proposal of applying tests to the crude resin (see preceding abstract). L. DE K.

Examination of Resins. XI. Anime, Caranna, Dammar, Labdanum, Mastic, Sandarac, Tacamahaca, and Turpeth. By KARL DIETERICH (*Chem. Centr.*, 1899, ii, 541; from *Pharm. Centr.-Halle*, 40, 453—457).—A table giving the acidity, ether, and saponification numbers of the following resins: East and West Indian anime, caranna resin, several varieties of dammar, dammar adulterated with colophony, several varieties of mastic, labdanum, sandarac, tacamahaca resin, and turpeth resin. The acidity numbers of dammar and sandarac should be determined by dissolving 1 gram of the sample in 20 c.c. of $N/2$ alcoholic potash, adding 50 c.c. of benzene, and, after 24 hours, titrating the excess of alkali with $N/2$ sulphuric acid. L. DE K.

Examination of Resins. XII. Ammoniacum, Bdellium, Galbanum, Opoponax, and Sagapenum. By KARL DIETERICH (*Chem. Centr.*, 1899, ii, 542—543; from *Pharm. Centr.-Halle*, 40, 467—471).—A table showing the acidity, ether, and saponification

numbers of gum ammoniacum, bdellium, galbanum, opoponax, and sagapenum.

The acidity numbers of ammoniacum and galbanum are obtained by boiling 1 gram of the finely powdered sample with 50 grams of water and 100 grams of alcohol for 15 minutes in a reflux apparatus, 75 grams of the filtrate are then mixed with 10 c.c. of $N/2$ alcoholic potash, and after waiting for 5 minutes, the excess of alkali is titrated with $N/2$ sulphuric acid. The saponification number is found by using the author's cold benzene process.

The other resins are treated as follows: 1 gram of the sample is heated for 15 minutes with 30 c.c. of water, 50 c.c. of alcohol are added and the boiling continued for the same time; the liquid is then at once titrated with $N/2$ alcoholic potash. The saponification numbers are found by boiling 1 gram of the sample first with 30 c.c. of water and then adding 25 c.c. of $N/2$ alcoholic potash, the excess of which is afterwards titrated.

L. DE K.

Detection of "Saccharin" in Beer. By R. RÖSSING (*Chem. Centr.*, 1899, ii, 274; from *Zeit. öffentl. Chem.*, 5, 207—208).—The beer is acidified with phosphoric acid and shaken with an equal bulk of ether. The residue left on evaporating the ethereal extract is mixed with a little sand, dried in the water-oven, the powdered mass extracted with absolute ether, and an equal volume of benzene is added. The filtrate is then evaporated on a watch glass and the residue dried over sulphuric acid. The "saccharin" is thus obtained in white crystals of characteristic sweet taste.

L. DE K.

Colour Reaction for the Detection of Benzidine and Tolidine. By JULES WOLFF (*Chem. Centr.*, 1899, ii, 569; from *Ann. chim. anal. appl.*, 4, 263—264).—The substance is dissolved in a little glacial acetic acid, the liquid diluted with water, and lead dioxide suspended in water added; a splendid blue coloration is developed which is permanent in the cold. If other organic acids are used, the colour is not so intense. With a small amount of bromine, a blue coloration forms, but with excess a blue precipitate is obtained. Mineral acids prevent the reaction with either lead dioxide or bromine.

L. DE K.

Simple Alkalimetric Method for the Estimation of Salt-forming Alkaloids with the Aid of Phenolphthalein as Indicator. By HARRY M. GORDIN (*Pharm. Archives*, 1899, 2, 313—318, and *Ber.*, 1899, 32, 2871—2876).—The periodides (Abstr., 1899, i, 89) or mercuriodides (Prescott, Abstr., 1882, 664) of alkaloids, precipitated respectively by Wagner's and by Mayer's reagent, contain an indefinite amount of iodine or mercuric iodide, but apparently always a definite amount of hydrogen iodide, as represented by the formula, $m\text{Alk.}, \text{HI} + n\text{I}$, or $m\text{Alk.}, \text{HI} + n\text{HgI}_2$. This fact may be utilised for the estimation of alkaloids by titration. About 0.2 gram of anhydrous morphine is dissolved in 30 c.c. of standard hydrochloric acid (about $N/20$) in a 100 c.c. flask, Wagner's reagent (containing about 1 per cent. of free iodine and $1\frac{1}{2}$ of potassium iodide) added

gradually, the whole being shaken well after each addition, until further addition produces no further precipitate, when the contents are diluted to 100 c.c. and again shaken well. After the precipitate has settled thoroughly the liquid is filtered, 50 c.c. of the red filtrate decolorised by the gradual addition of 10 per cent. sodium thiosulphate solution, a few drops of phenolphthalein added, and the excess of acid titrated with *N*/20 potassium hydroxide. It is found that 1 c.c. of the acid is removed by 0.0137 gram of morphine; the equivalent quantities are, of hydrastine, 0.0184; strychnine, 0.0160; caffeine cryst., 0.0102; cocaine, 0.0146, and atropine 0.0139 gram. These alkaloids were then estimated in the same way, the factors just quoted being used in the calculation; the amounts found differed by about 1 per cent. only from those taken. Of Mayer's and Wagner's reagents that one is used which effects the more complete precipitation; if they are equal in this respect, Mayer's reagent is to be preferred, as the precipitate it produces settles more easily; when it is used, too, the subsequent addition of thiosulphate is unnecessary. Caffeine requires 50 c.c. of acid; colchicine cannot be estimated by this method, nor can berberine, which does not carry down any acid.

C. F. B.

Alkaloid resembling Aconitine found in a Corpse. By MECKE (*Chem. Centr.*, 1899, ii, 256—257; from *Zeit. öffentl. Chem.*, 5, 204—206. Compare Abstr., 1899, 311).—A ptomaine with properties very similar to those of aconitine has been found in a corpse. This alkaloid is extracted from alkaline solutions by ether, and gives the general reactions of the alkaloids, forming with phosphotungstic acid a white, with phosphomolybdic acid a yellow, and with a solution of iodine in potassium iodide a brownish precipitate. It gives a faint turbidity with mercuric chloride, and with concentrated sulphuric acid it forms, after a time, a reddish-violet coloration, which changes to a darker shade on warming. It remains colourless with dilute sulphuric or phosphoric acid, but becomes violet on evaporating. The yellowish solution in nitric acid, when evaporated, leaves a yellow residue which turns orange when moistened with potassium hydroxide solution. Even very small quantities instantly reduce potassium ferricyanide, and with Fröhde's reagent the alkaloid gives a greenish coloration, changing to yellowish-brown on warming. It is not precipitated by tannic acid, and after adding bromine water it is not attacked by concentrated sulphuric acid; potassium dichromate has also no action on it.

The violet coloration obtained by treating aconitine with phosphoric acid or concentrated or dilute sulphuric acid is only slowly formed, and differs from that of the corpse alkaloid both in shade and intensity. Delphinine, although stated by Otto to give a violet coloration with phosphoric acid, was found to produce only a brownish coloration, and its behaviour with sulphuric acid and bromine is not like that of the ptomaine.

The present methods of testing for aconitine are only to be trusted when considerable quantities are present and decomposed animal matter absent. Hilger and Tamba's reaction with phosphoric acid is

not available in presence of ptomaines, and, moreover, is scarcely characteristic of aconitine, for the different commercial varieties give different reactions. Urine which is several days old, when evaporated with phosphoric acid, also gives the same violet coloration as aconitine. The reactions with concentrated sulphuric acid, potassium ferricyanide (Brouardel-Boutmy's reaction), and Föhde's reagent are also untrustworthy. According to Jürgens, characteristic crystals of aconitine potassium iodide are obtained by dissolving the alkaloid in a drop of dilute acetic acid, evaporating with a grain of potassium iodide, and washing with water, but in many cases this test gave only amorphous precipitates or the tabular crystals of pseudoaconitine.

E. W. W.

Delicate Test for Caffeine. By ANDREA ARCHETTI (*Chem. Centr.*, 1899, ii, 453; from *Boll. Chim. Farm.*, 38, 340—341).—A solution of potassium ferricyanide is mixed with half its volume of nitric acid and heated to boiling. On adding an aqueous solution of caffeine a deposit of prussian blue will be noticed. The reaction is also given by other xanthine bases and uric acid, but only very feebly.

L. DE K.

Estimation of Cornutine. By FRANZ MUSSET (*Chem. Centr.*, 1899, ii, 323; from *Pharm. Centr.-Halle*, 40, 396).—The ethereal solution obtained according to Keller's directions contains, besides the cornutine, a resinous matter causing high result. By treating the weighed residue repeatedly with water containing 0.5 per cent. of hydrogen chloride, the cornutine dissolves and the insoluble resin may be weighed and allowed for.

L. DE K.

Recognition of Morphine and its Derivatives. By RUDOLF ROBERT (*Chem. Centr.*, 1899, ii, 149—150; from *Sonderabdruck aus Apoth.-Zeit.*, 14, No. 37).—The reagent proposed by the author's pupil Marquis is prepared by mixing 2—3 drops of formaldehyde solution with 3 c.c. of concentrated sulphuric acid. The pulverised alkaloid is added to this in a porcelain basin. *Morphine* gives at first a purple-red, passing through violet to almost pure blue; if partially protected from the air by placing in a test-tube, the blue colour remains for a long time. *Dionine* gives a deep blue, *codeine* a violet, *heroine* a reddish-violet turning to bluish-violet, *peronine*, a permanent reddish-violet, *methylphenomorpholine* an intense red. The absorption spectra of these coloured solutions show small differences.

M. J. S.

Estimation of Chloral Hydrate and Morphine in Organs. By RUSSWURM (*Chem. Centr.*, 1899, ii, 794; from *Pharm. Centr.-Halle*, 40, 543—544).—The united distillates from an acid and an alkaline distillation, containing therefore both chloral hydrate and chloroform, is diluted with alcohol to a definite bulk, and the chlorine estimated by boiling an aliquot part with alcoholic potash in a reflux apparatus, neutralising with nitric acid, and titrating with silver nitrate.

Morphine is estimated by first extracting the ammoniacal solution with hot amyl alcohol, which is, in turn, shaken with dilute hydrochloric acid. According to the author, the alkaloid may now be

obtained by supersaturating the liquid with ammonia and agitating with chloroform; this is then concentrated to a few c.c. in a small weighed beaker, and the morphine completely precipitated by adding 50 c.c. of light petroleum of low boiling point. L. DE K.

Estimation of Santonin in the Flower Buds of *Artemisia Maritima*. By KARL THAETER (*Arch. Pharm.*, 1899, 237, 626—632).—The author defends his method (Abstr., 1898, ii, 59) against Katz's criticisms (*Arch. Pharm.*, 1899, 237, 245). The extraction with ether must be continued for 12—18 hours. Before the magnesia is added, the solution should be evaporated to dryness, and the residue powdered; after mixture, the whole is moistened evenly with water and dried as rapidly as possible; there is then little fear that any of the santonin will be converted into magnesium salt. C. F. B.

Estimation of Urinary Indican. By EYVIN WANG (*Zeit. physiol. Chem.*, 1899, 28, 576—584. Compare Abstr., 1898, ii, 659; 1899, ii, 458).—The author defends his method against the criticisms of Bouma (Abstr., 1899, ii, 568). He holds that the method of purification described is necessary and correct, for the reddish-brown pigment removable by alcohol does not originate from indigo. W. D. H.

Volumetric Estimation of Sodium Cacodylate. By HENRI IMBERT and A. ASTRUC (*J. Pharm.*, 1899, [vi], 10, 392—395).—Cacodylic acid is neutral to methyl-orange, but behaves as a monobasic acid towards phenolphthalein, whereas pure sodium cacodylate is alkaline to methyl-orange and neutral to phenolphthalein. The commercial salt, however, is always acid to phenolphthalein, due to the presence of free acid. 1.6 grams of sodium cacodylate are dissolved in 100 c.c. water and to 10 c.c. of this solution carefully neutralised, using phenolphthalein as indicator, decinormal hydrochloric acid or sulphuric acid is then added until the liquid is neutral to methyl-orange. The number of c.c. of acid required multiplied by ten gives the percentage of pure sodium cacodylate. H. R. LE S.

Separation of Proteids from Flesh-bases by means of Chlorine and Bromine. By HARVEY W. WILEY (*Chem. Centr.*, 1899, ii, 586; from *Chem. News*, 80, 88—89).—The freshly powdered dry material, from which the fat has been removed by ether, is first extracted with cold and then with hot water and the extract filtered. The amount of proteids insoluble in water is calculated by multiplying the difference between the amount of nitrogen in the original material and that in the insoluble portion by 6.25. The filtrate, after acidifying with hydrochloric acid, is oxidised by repeatedly shaking with bromine. After remaining over night, the precipitated proteids are filtered and washed with water. The amount of flesh bases is obtained by multiplying the difference between the total amount of nitrogen and the sum of the amount of nitrogen in the soluble and in the insoluble proteids by 3.12. Liebig's extract was found by this method to contain 8.92 per cent. of proteids, previous determinations having given lower results. E. W. W.

Source of Error in Testing for Albumin in Urine. By E. DEBOISE and OUI (*Chem. Centr.*, 1899, ii, 570; from *Ann. chim. anal. appl.*, 4, 261—262).—Before being tested for albumin, the urine, if not quite clear, should be filtered; if, however, the turbidity is caused by micro-organisms, the ordinary filter fails and a so-called Kitasato filter must be employed.

It has been proposed to clarify the urine by means of calcined magnesia, but the authors find that this also precipitates most of the albumin.

L. DE K.

Microchemistry of Crystalline Hæmatin Compounds. Detection of Blood. By CASIMIR STRYZOWSKI (*Chem. Centr.*, 1899, ii, 140, 225; from *Oesterr. Chem. Zeit.*, 1899, 2, 305, 333—335).—Largely a repetition of earlier work. Ox-blood freed from salts, cholesterol, and fat was employed. None of Husson's results can be confirmed, except those relating to the formation of bromine and iodine compounds of hæmatin. Axenberg's mercury and manganese hæmatin compounds are non-existent. Buffalini's method (*Abstr.*, 1886, 184) must also be rejected, since the halogens (iodine, however, the least) destroy the colouring matter of blood. The results obtained by Bikfalvi (*Abstr.*, 1887, 165) by adding acetic acid and a haloid salt of an alkali metal to dialysed blood, appear to be perfectly correct. The so-called hæmidin crystals obtained by Dannenberg and others (*Abstr.*, 1887, 408) are nothing but sulphur. Teichmann's method simplified as follows will detect 0.000025 gram of blood. To the dried substance on a microscope slide with cover, acetic acid mixed with 1/50 vol. of hydriodic acid is added and the object is heated for a short time; well formed black crystals are obtained. Another very sensitive reagent is a mixture of 10 c.c. of glycerol of sp. gr. 1.26 with 2—3 drops of concentrated sulphuric acid. Blood, when heated with a very small quantity of this reagent on an object glass and examined with a magnifying power of 400 diameters, shows small, dark needles of hæmatin sulphate.

M. J. S.

Detection of Yolk of Egg in Margarine. By MECKE (*Chem. Centr.*, 1899, ii, 321—322; from *Zeit. öffentl. Chem.*, 5, 231—232).—Margarine melted at 45° is shaken with half its volume of a 1 per cent. solution of salt. The aqueous liquid is freed from fat by agitating with light petroleum and then cleared by alumina-cream. The filtrate is diluted with 5 times its bulk of water, when if yolk of egg is present in the sample, an abundant, flocculent precipitate of vitellin will be obtained. Or the margarine may be dissolved in light petroleum, the undissolved matter washed with ether, and then treated with salt solution.

L. DE K.

Detection of Albumoses in Urine. By LUDWIG VON ÁLDOR (*Chem. Centr.*, 1899, ii, 728—729; from *Berl. Klin. Woch.*, 36, 764—767, 785—787).—Any albumin is first removed by precipitation with trichloroacetic acid. 6—10 c.c. of the urine are acidified with 1—2 drops of hydrochloric acid and precipitated with slight excess of 5 per cent. solution of phosphotungstic acid. The precipitate is repeatedly whirled in a centrifugal apparatus with absolute alcohol

until all colouring matter is extracted and then suspended in water and mixed with aqueous sodium hydroxide. A blue coloration is noticed, which, however, fades on exposure to the air; the colourless liquid is then treated, as usual, with copper sulphate. L. DE K.

Analysis of Rubber Wares. By ROBERT HENRIQUES (*Zeit. angew. Chem.*, 1899, 802—804. Compare Abstr., 1893, ii, 399, and 1895, ii, 96, 191).—*Estimation of the total Sulphur and Metals.* The process does not materially differ from the former one, being carried out by oxidising with nitric acid, neutralising with excess of soda, and fusing the dry mass; the aqueous solution of this will contain the sulphur as sodium sulphate, whilst the metallic compounds remain as oxides or carbonates in the insoluble residue. For the detection and estimation of vermilion, which is often present in small quantities, the substance is digested with nitric acid, which gradually decomposes and dissolves the mercury sulphide; after expelling the bulk of the acid and diluting with water, the liquid is precipitated with hydrogen sulphide and the mercury looked for in the metallic sulphides so obtained.

Estimation of "Faktis" in Vulcanised Wares.—It is now recommended that the mass which has been exhausted with alkali shall be removed from the filter before drying to constant weight.

Estimation of Unsaponifiable Oils in Vulcanised Wares.—The mass, after being extracted with alkali, dried, and weighed, is again extracted with ether, the loss in weight representing the unsaponifiable matter, such as rosin-oil, paraffin, &c.

Estimation of "Faktis" in Non-vulcanised Wares.—The old process was not always satisfactory, and the following method has been substituted for it: 5 grams of the rasped sample is covered with 25 c.c. of benzene and heated on a boiling water-bath for an hour, the Erlenmeyer flask being attached to a reflux condenser; the whole is then left over night. The mass may now be successfully attacked by alcoholic soda.

Estimation of Unsaponifiable Oils in Non-vulcanised Wares.—Boiling acetone is substituted for ether and after evaporating the solvent, the residual unsaponifiable matter is weighed.

Estimation of Carbonic Anhydride.—Attention is called to the importance of estimating the carbonic anhydride present in combination with calcium, lead, zinc, &c. When dealing with non-vulcanised wares, the sample should first be repeatedly extracted with boiling nitrobenzene to remove the bulk of the rubber so as to facilitate the action of acids.

L. DE K.

General and Physical Chemistry.

Indices of Refraction of Metals. By EDMOND VAN AUBEL (*Zeit. physikal. Chem.*, 1899, 30, 565—566).—A comparison of the indices of refraction of metals obtained by calculation from the molecular refraction of salt solutions with those obtained directly by Drude (*Ann. Phys. Chem.*, 1890, [ii], 37, 537). The values show fair agreement in some cases, but in others are of a different order of magnitude, for example, silver, 2.37 and 0.203. Kundt's law, which states that the product of the index of refraction and electrical conductivity is constant, does not hold for either the direct or calculated values.

L. M. J.

Colour Changes of Illuminated Substances. By HEINRICH BILTZ (*Zeit. physikal. Chem.*, 1899, 30, 527—528).—Marchwald has given an account of these changes to which he has applied the term 'phototropy' (this vol., ii, 2). To the sensitive compounds there mentioned may be added the hydrazone of benzaldehyde and cuminal-osazone, anisilosazone, and piperilosazone. These compounds are yellow or greyish-yellow, but on exposure to light become red or orange in about an hour, returning again to the original colour in the dark. Benzilosazone, salicylosazone, and vanillylosazone are, however, not phototropic.

L. M. J.

Chemical Effects produced by Becquerel Rays. By P. CURIE and SKŁODOWSKA CURIE (*Compt. rend.*, 1899, 129, 823—825).—The radiations from highly radio-active barium salts convert atmospheric oxygen into ozone, and the latter is readily detected in the air of closed flasks containing the radio-active compounds. The compounds producing this result are all luminescent and highly radio-active, but their effect on oxygen seems to be connected with radio-activity rather than with luminescence.

The radiations also affect glass, and the vessels containing the salts gradually become deep violet and almost black, especially where the glass is in contact with the salt, even if the glass does not contain lead. The intensity of the coloration and the time required for its production depend on the intensity of the radio-activity.

Barium platincyanoide, under the influence of these radiations, becomes dark coloured and less fluorescent, but regains its original colour when exposed to sunlight, and at the same time becomes phosphorescent. Villard has obtained similar results with Röntgen rays (compare also Giesel, *Ann. Phys. Chem.*, 1899, [ii], 69, 91).

C. H. B.

Chemical Action of the X-Rays. By P. VILLARD (*Compt. rend.*, 1899, 129, 882—883. Compare preceding abstract).—The darkening of the wall of a Crookes' tube, which has been working for some time, is due to the reduction of the lead present in the glass to the metallic state by the cathode rays. If these are cut off by a thin

sheet of aluminium, which is transparent to the X-rays, the glass is coloured violet. This is due to the oxidising action of the X-rays, and the coloration is no doubt due to the manganese present in the glass.

H. R. LE S.

Phosphorescence Phenomena produced by the Radiations from Radium. By HENRI BECQUEREL (*Compt. rend.*, 1899, 129, 912—917).—The author finds that, in general, substances which phosphoresce when exposed to the action of ultra-violet rays, or of the X-rays, also become luminous under the influence of the radiation emitted by radio-active barium chloride; the order of the relative intensities of the luminous effects is, however, not the same in the two cases.

The phosphorescence excited by radium in certain minerals shows great persistence; fluorite, for example, remains luminous 24 hours after the influence of the radium has ceased.

When phosphorescent substances, which have been heated and thus rendered incapable of phosphorescence, are subjected to the action of an electric spark or to the prolonged action of the violet and ultra-violet rays, they are found to possess the property of exhibiting phosphorescence on heating. Fluorite, in these circumstances, emits a greenish-blue light, and the author finds that this mineral, after heating and exposing it to the radium radiation, gives out when heated a greenish-blue light which spectroscopic analysis shows to be identical with that produced by the electric spark.

T. H. P.

Influence of the Magnetic Field on the Rays Emitted by Radio-active Substances. By HENRI BECQUEREL (*Compt. rend.*, 1899, 129, 996—1001).—The radio-active substance used was barium chloride, and the influence of the magnetic field on the rays emitted by it was investigated by means of a fluorescent screen or a photographic plate. The author confirms the observations of Meyer and von Schweidler (*Physikalische Zeitschrift*, No. 10, 113—114) that some of the rays follow the direction of the magnetic field and are undeflected, whereas those in a plane at right angles to the magnetic field are deflected.

The results obtained point to a close relationship between cathodic rays and the rays emitted by radio-active substances. H. R. LE S.

Radiation of Radio-active Substances. By HENRI BECQUEREL (*Compt. rend.*, 1899, 129, 1205—1207). **Action of the Magnetic Field on Becquerel Rays: Deflected and Undeflected Rays.** By P. CURIE (*Compt. rend.*, 1900, 130, 73—76). **Penetration of Undeflected Becquerel Rays.** By SKŁODOWSKA CURIE (*Compt. rend.*, 1900, 130, 76—79).—The rays emitted by a very active specimen of Curie's polonium are not deflected in the magnetic field; the experiments were made about a month after the preparation of the substances, and the results are contrary to those obtained by Giesel with freshly prepared polonium compounds (this vol., ii, 19).

A portion of the rays emitted by radium are deflected by the electro-magnet; these behave like Röntgen rays, their velocity is of the same order, and their penetrating power increases with the thickness of the absorbent layer; the undeflected rays correspond with those from

polonium, and their penetrating power varies in the opposite sense to that of the deflected rays.
G. T. M.

Electromotive Behaviour of Chromium. By WILHELM HITTORF (*Zeit. physikal. Chem.*, 1899, 30, 481—507).—The peculiarities in the electromotive behaviour of chromium are further investigated (compare Abstr., 1898, ii, 363), and the author advances many arguments in support of the view that the inactive state cannot be due to the formation of a film of oxide. Owing to the existence of the different classes of chromium compounds, the metal may exhibit any potential between the two extreme values; the highest value corresponds with the active state in which chromium gives rise to the lower compounds. This active state is assumed when the metal is placed in sulphuric, oxalic, hydrofluosilicic, or the halogen acids, at temperatures which are lower the more concentrated the acid; it is also active in fused halogen salts or in their boiling solutions. The metal becomes inactive when immersed in solutions containing free chlorine or bromine, or in strong oxidising agents. The limiting values, however, last but a short time after removal from the liquids, the metal speedily assuming an intermediate state; the most stable active state is that produced by fused halogen salts. The activity is also lowered in all cases when the metal serves as an anode for a current produced either externally or internally, and, with sufficiently strong currents, chromic acid is produced, either by decomposition of water by anion and subsequent union of the metal and oxygen, or by the intermediate formation of a compound of the anion and chromium. When the metal is used as a cathode, it rapidly assumes the active state. The author points out that Berzelius and Wöhler had previously observed differences in chromium under different conditions.
L. M. J.

Influence of the Addition of a Salt with one similar Ion on Electromotive Force and Diffusion Velocity. By RICHARD ARREGG and EMIL BOSE (*Zeit. physikal. Chem.*, 1899, 30, 545—555).—A theoretical investigation of the above question. It is shown that if u and v are the cation and anion velocities, the addition of a salt with a similar cation or anion causes change of velocity of diffusion, tending to the values $V. (u + v)/2v$ or $V. (u + v)/2u$ respectively. In acids, the cation has a velocity about six times that of the anion, whilst in bases the velocity of the OH^- anion is about three times that of the cation. The velocity of diffusion of an acid or of a base hence is greatly increased by the addition of one of its neutral salts, and experiments are recorded in verification of this. Similarly, owing to the slight velocity of MnO_4^- and CrO_4^- ions, the diffusion of potassium permanganate or potassium chromate is decreased by the addition of potassium chloride. The increase of the catalytic action of an acid caused by the addition of its salts may be due to the increased mobility of the hydrogen ion.
L. M. J.

Molecular Susceptibility of the Salts of the Rare Earths. By H. DU BOIS and OTTO LIEBKNECHT (*Ber.*, 1899, 32, 3344—3348).—In determining the molecular susceptibility of a paramagnetic salt,

the substance is added to water until its paramagnetism just counterbalances the diamagnetism of the solvent; when this is the case, the meniscus of a portion of the solution contained in a capillary tube placed between the poles of an annular electromagnet remains stationary, whereas it moves backwards or forwards if the solution is either para- or dia-magnetic. The molecular susceptibility of the salt is then calculated from the equation $i_m = -m.M_w/M_s.x$ where m is the molecular weight of salt, M_w/M_s the ratio between the weights of water and salt in the non-magnetic solution, and x the specific susceptibility of water at 18° ; the exact value of this constant is not known, and the number 0.75×10^{-6} is employed as an approximation; the results, however, may be expressed in the form $-i_m/x$, and this expression is independent of the constant. The results obtained with the salts of eight of the rare earths are tabulated in the following manner:

	Salt, RCl_3 .	Atom. wt. ($O=16$).	Mol. wt. m .	$\frac{M_w}{M_s}$.	$-\frac{i_m}{x}$.	i_m .
1.	Yttrium chloride	89.0	195.35	1.41	276	0.00021
2.	{ Cerium "	140.0	246.35	13.197	3250	0.00243
	" bromide	"	379.88	8.4398	3210	0.00240
3.	Praseodymium chloride.	140.4	246.75	17.72	4370	0.00328
4.	{ Neodymium "	143.6	249.95	27.995	7000	0.00525
	" nitrate.....	"	329.72	20.98	6920	0.00519
5.	Samarium chloride	150	256.35	60.52	15510	0.01164
6.	Gadolinium "	156	262.35	130.24	34170	0.02563
7.	Erbium "	166	272.35	179.59	48910	0.03668
8.	Ytterbium "	173	279.35	33.95	9480	0.00711

These figures show that the salts investigated are derived from a well-defined group of paramagnetic elements, corresponding with the group chromium, manganese, iron, cobalt, nickel, and copper. In both cases, it is found that when the elements are arranged in the order of their atomic weights, the susceptibility is least for the salt of lowest atomic weight, also that it rises to a maximum, and then falls again. In the chromium-copper group, the maximum is reached at the third member (iron); cobalt is more paramagnetic than nickel, although recent atomic weight determinations place the latter nearer to iron. In the rare earth group, the maximum is reached only at the seventh stage (erbium), and then drops suddenly to ytterbium; in this group the increase and decrease of paramagnetism is strictly in accordance with the ascending order of the atomic weights.

G. T. M.

Change of Thermal Conductivity during Melting. By EDMOND VAN AUBEL (*Zeit. physikal. Chem.*, 1899, 30, 563—564).—The results of Lees (*Phil. Trans.*, 1898, 191, 428) have shown that fusion is not necessarily accompanied by a sudden change of conductivity. In the case of water, however, the conductivity at 0° is 0.072 and in the solid state between -21° and 0° about 0.30, so that, most probably, a sudden change occurs during the melting of ice.

L. M. J.

Influence of Pressure on the Critical Temperature of Complete Mixture. By N. J. VAN DER LEE (*Proc. K. Akad. Wetensch. Amsterdam*, 1898, 1, 158—165).—For two liquids, only partly soluble in each other, there exists a temperature above which mixture in all proportions is possible. The influence of pressure on this phenomenon has been investigated for mixtures of water and phenol, the critical temperature of complete mixture being in this case about 67° . The mixture to be investigated was contained in a thick glass tube of small bore, and subjected to pressures of 1—180 atmospheres; an electromagnetic stirring apparatus secured thorough mixing of the components in the tube. By means of a thermostat, in which ethyl alcohol boiled under varying pressures, the mixture could be kept at the desired temperature.

The temperature of complete mixture was in all cases found to rise slightly with increase of pressure; thus, in a case where 34 per cent. of phenol was present, the temperature of complete mixture was 67.6° under a pressure of 1 atmosphere, and 68.1° under a pressure of 130 atmospheres. The temperature of complete mixture was highest for the composition just referred to.

Theoretical considerations point to the curve $p=f(x)$, connecting the composition and pressure of the saturated vapour of the mixture, having a maximum or minimum when there is 34 per cent. of phenol present. The vapour pressures of numerous mixtures of water and phenol have accordingly been determined for the temperature range 71 — 90° . The composition of the mixture with maximum vapour pressure for any given temperature, cannot be exactly determined from the numbers obtained, but it is close to 34 per cent. of phenol.

J. C. P.

Hydrate of Sodium Dioxide and Preparation of Hydrogen Peroxide. By ROBERT DE FORCRAND (*Compt. rend.*, 1899, 129, 1246—1249).—The heat of dissolution of the hydrate $\text{Na}_2\text{O}_2 \cdot 8\text{H}_2\text{O}$ is -14.868 Cal.; its heat of formation from sodium dioxide and water is 34.081 Cal., and from the dioxide and ice, 22.641 Cals. These values indicate that the hydrate is possessed of considerable stability, and on this account it may be employed in the preparation of hydrogen peroxide; it furnishes a strong solution of this compound when dissolved in cold hydrochloric acid. The reaction Na_2O diss. + H_2O_2 diss. = Na_2O_2 diss. is accompanied by an evolution of 4.713 Cals. For the solid substances, the stable condition is Na_2O_2 , for 27.755 Cals. are evolved during the combination of oxygen with solid Na_2O ; in solution, the stable condition is $\text{Na}_2\text{O} + \text{O}$, for the addition of oxygen to dissolved Na_2O is attended by an absorption of heat equal to -16.987 Cals.

G. T. M.

Compound Metallic Radicles: Mercury Derivatives. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1899, 129, 918—920).—The following heats of combustion and formation have been determined:

	Combustion.		Formation.
	At const. vol.	At const. press.	
Mercurymethyl (liq.)	430·8 cal.	431·8 cal.	—36·2 cal.
Mercurydiethyl (liq.)	733·6 "	735·0 "	—12·8 "
Mercurydiphenyl (cryst.) ...	1563·8 "	1565·3 "	—88·5 "

T. H. P.

Compounds of Lithium Chloride with Ethylamine. By J. BONNEFOI (*Compt. rend.*, 1899, 129, 1257—1259).—The compound, $\text{LiCl}, \text{NH}_2\text{Et}$, produced when ethylamine is passed over lithium chloride heated above 70° , is a white, porous substance the heat of dissolution of which in water is 7·503 Cal.; its heat of formation determined experimentally is 13·834 Cal., the value calculated by Clapeyron's formula being 13·717 Cal. The substance closely resembles the corresponding methylamine and ammonia compounds the heats of formation of which are respectively 13·820 and 11·842 Cals. (Abstr., 1897, ii, 371; 1899, ii, 96). The compound $\text{LiCl}, 2\text{NH}_2\text{Et}$ is formed at temperatures between 58° and 70° ; the heat of dissolution is 9·43 Cal. and the heat of formation is 24·817 Cal. The heat evolved by the fixation of the second molecule of the amine calculated from the dissociation pressures of the substance by Clapeyron's formula is 11·09 Cal. The compound $\text{LiCl}, 3\text{NH}_2\text{Et}$ is obtained below 58° , and even when the liquid amine was employed no further combination took place; the heat of dissolution is 11·77 Cal. and the heat of formation 35·387 Cal. The heat evolved during the fixation of the third molecule of the amine is 10·57 Cal. determined calorimetrically, and 10·503 Cal. calculated by Clapeyron's formula from the dissociation pressures.

G. T. M.

Lactic Acid. By MARCELLIN P. E. BEETHELOT and MARCEL DELÉPINE (*Compt. rend.*, 1899, 129, 920—926).—Thermochemical data for silver and zinc lactates and for lactide are given in the following table:

	Heat of combustion			Heat of formation		solution.
	1 gram.	1 mol. at const. vol.	1 mol. at const. press.	from elements.		
$\text{C}_3\text{H}_5\text{O}_5\text{Ag}$	1609·7 cal.	316·6 Cal.	316·5 Cal.	138·9 Cal.		—2·05 Cal.
$(\text{C}_3\text{H}_5\text{O}_5)_2\text{Zn}$...	2592·1 "	640·15 "	640·15 "	355·45 "		+8·00 "
$\text{C}_3\text{H}_5\text{O}_5$	4542·8 "	327·1 "	327·1 "	93·8 "		+2·10 "

The heats of neutralisation of lactic acid are: with $\frac{1}{2}\text{Ag}_2\text{O}$, 4·1 Cal.; with $\frac{1}{2}\text{ZnO}$ (hydrated), +9·95 Cal.; and with $\frac{1}{2}\text{ZnO}$ (anhyd.) +9·3 Cal.

These numbers give, for the heat of formation of lactic acid from its elements, mean values of 163·2 Cal. for the pure liquid acid and 164·3 Cal. for the dissolved acid.

T. H. P.

Heats of Fractional Neutralisation of Carbonylhydroferrocyanic Acid compared with those of Hydroferrocyanic Acid. By JOSEPH A. MULLER (*Compt. rend.*, 1899, 129, 962—964).—Each addition of one-fourth of the equivalent quantity of potash to a

dilute solution of a gram-mol. of hydroferrocyanic acid gives a heat development of almost exactly 14 Cals., the total at 18°6' being 56·18 Cals. Sensibly the same number of Cals. (14) are liberated when carbonylhydroferrocyanic acid is neutralised by thirds in dilute solution, the mean total heat evolutions being, at 19·4° with potash, 41·91 Cals., and at about 18° with baryta, 42·29 Cals.

Thus, carbonylhydroferrocyanic acid is a strong acid, and the replacement of HCN in the molecule of hydroferrocyanic acid by the carbonyl group has no appreciable influence on the acidic properties of the remaining hydrogen atoms.

T. H. P.

Narceine. By ÉMILE LEROY (*Compt. rend.*, 1899, 129, 1259—1261).—The heat of hydration of narceine is 6 Cal. for the dihydrated form, and, in addition, 3 Cal. are evolved when this is converted into the trihydrate. The heat of combustion is 2790·9 cal. at constant volume, and 2792·2 cal. at constant pressure. The heat of formation of the anhydrous base is 302·2 Cal., that of the dihydrate being 308·24 Cal. The heat of neutralisation of the dihydrated form in excess of hydrochloric acid is - 4·62 Cal., whilst that of the anhydrous base is 1·58 Cal. The hydrochloride, $C_{23}H_{27}O_8N, HCl$, crystallises, with $3H_2O$, from a solution containing excess of acid; the heat of hydration of the salt is 6·76 Cal. with water, and 2·08 Cal. with ice, the heat of formation of the anhydrous salt being 21·52 Cal. The heat of formation of the potassium derivative, $C_{23}H_{26}O_8NK$, is 16·7 Cal., the heat evolved on adding potassium hydroxide solution to an aqueous solution of the alkaloid being 11·5 Cal.

Narceine is the least basic of the opium alkaloids, and, like narcotine, is neutral to litmus; the heat of formation of the potassium derivative indicates a distinctly acidic function, the substance being intermediate in stability between the acetates or benzoates and the phenoxides.

G. T. M.

Fractional Distillation under Reduced Pressure. By GIUSEPPI ODDO (*Gazzetta*, 1899, 29, ii, 355—357).—The apparatus described consists of a T-piece fitted to the end of the condenser by means of a piece of rubber tubing which is slightly greased so as to allow of the T-piece being rotated. To the two branches of the latter are fitted two receivers, one being an ordinary flask, and the other an Erlenmeyer flask which is also in connection with the pump used for exhaustion. After the first fraction has been collected in one of these receivers, the T-piece is turned round so that the second receiver comes into use. If more than two fractions are required, to each branch of the T-piece another T-piece is fitted by means of a piece of greased rubber tubing; in this way, four fractions are obtainable.

T. H. P.

Determination of Freezing Points in Dilute Solutions. By MEYER WILDERMANN (*Zeit. physikal. Chem.*, 1899, 30, 508—526).—A consideration of the errors which must exist in thermometric determinations of freezing points. The formation of ice caps and nets is probably due to the presence of variable quantities of air and organic compounds in the water; these impurities also, although not indicated by the conductivity, may occasion variations of the freezing point, to

the extent of a few thousandths of a degree. Changes of external and internal pressure may also cause errors, the variation of the observed freezing point with the author's $1/1000^{\circ}$ thermometer being about 0.0003° per mm. of mercury. For accurate work also, the thermometer should be always kept at a temperature approximately equal to zero and not at the ordinary temperature. The effect of variations in the external temperature is also considered, but a more subtle source of error lies in the existence in the thermometer of rough places and dead points, which the mercury is unable to pass when the actual temperature is sufficiently near. Errors are also introduced owing to inaccuracies of calibration, and accuracy is hence frequently expected beyond that possible; for example, if an accuracy of 0.0001° is required with a $1/100^{\circ}$ thermometer, then the calibration should be performed with a mercury thread of about 1 mm. in length. Other errors not due to causes inherent in the method are also considered, and the author replies briefly to criticisms on his work (compare Abstr., 1896, i, 352, 587).
L. M. J.

Freezing Points of Mixed Crystals of Two Compounds. By H. W. BAKHUIS ROOZEBOOM (*Zeit. physikal. Chem.*, 1899, 30, 385—412).—A theoretical consideration of the phenomena of solidification of mixed crystals under various conditions; the following types are considered. A. The liquid solidifies to a continuous series of mixed crystals; three different types of curves are obtained, namely, in the cases where (1) the freezing point for every mixture lies between those of the two constituents, (2) a maximum, and (3) a minimum occurs. Many examples of the first case have been examined; of the second, no case has been completely studied, but lead-thallium mixtures are probably an example, while the third type is exemplified by mixtures of mercuric bromide and iodide. The general law is deduced that in all cases the liquid phase is richer than the solid phase, in that constituent which, if added, causes a depression of the freezing point. B. When the mixed crystals form an interrupted series, two more types of curves result; (4) when the freezing point curve contains a transition point at which the two crystal mixtures occur together, whilst a maximum or minimum may also be present—an example of this type has been found in mixtures of sodium and silver nitrates; (5) an eutectic point occurs in the freezing point curve; examples are mixtures of thallium and lead nitrates (Van Eijk, next page), and also of naphthalene and monochloroacetic acid (Cady, Abstr., 1899, ii, 405). When two different classes of crystals result, new types of curves are obtained closely resembling 4 and 5, and the author discusses the means of determining the type of curve indicated by experimental determinations of the freezing point. The accounts of the experimental realisation of the various types mentioned in the paper are deferred.
L. M. J.

Transition Points in Mixed Crystals. By H. W. BAKHUIS ROOZEBOOM (*Zeit. physikal. Chem.*, 1899, 30, 412—429).—The possible types of curves for the transition of one set of mixed crystals to another are considered; the following types occur:—(1) A continuous series of mixed crystals, α , change to a continuous series, β ; the

forms of curve are analogous to types 1, 2, 3 in the preceding abstract, a complication being, however, introduced when only one component undergoes a transition; an example is the transition of mixtures of mercuric bromide and iodide. (2) A continuous series, α , change to a discontinuous series, β ; the transition curves are here analogous to types 4 and 5 of the freezing point curve, an example is probably the mixture of azoxyanisole and azoxyphenetole (Abstr., 1898, ii, 286); in this case also, transition of only one component may occur. (3) The mixed crystals form in the α state, and in the β state a continuous series; examples are the systems potassium and sodium nitrates, and sodium and silver nitrates. (4) The mixed crystals form discontinuous series in both states, an example being potassium and thallium nitrates (following abstract). (5) Isodimorphous mixed crystals change into a continuous or (6) an interrupted series of mixed crystals. Further types may occur in which the isodimorphous crystals are discontinuous, but these are not considered. L. M. J.

Formation and Transition of Mixed Crystals of Potassium and Thallium Nitrates. By C. VAN EIJK (*Zeit. physikal. Chem.*, 1899, 30, 430—459).—The melting point and transition curves were completely examined in the case of mixed crystals of the above compounds. The melting points of the pure compounds are: potassium nitrate 339° , thallium nitrate 206° , and an eutectic point occurs at 182° , the mixture containing 31 per cent. of potassium nitrate; the law stated by Roozeboom (preceding abstracts) regarding the composition of the solid and liquid phases was verified. During the solidification of the mass, the composition of the liquid phase changes continuously and the temperature falls; if the freezing is sufficiently slow, it is probable that the composition of the solid would also change, *pari passu*, until the whole mass solidifies at a final temperature corresponding with that at which the solid of the given composition is in equilibrium with a liquid phase. In the experiments, however, the solid phase was not found to change sufficiently rapidly, so that the final temperature is always lower than that deduced, as above, from the curves. As products of the freezing, a continuous series of rhombohedra were obtained to 20 per cent., and a second continuous series from 50 to 100 per cent. of potassium nitrate; for intermediate values, a conglomerate of the mixed crystals is obtained. The transition temperatures were obtained by both thermometric and dilatometric methods, as well as by the microscopical examination of the crystals. It was found that change to rhombic crystals occurs at 129° for potassium nitrate, and at 144° for thallium nitrate. For the mixed crystals, continuous transition curves are obtained from 144° to 133° on the thallium side, and from 129° to 108.5° on the potassium side. The conglomerate has, however, two transition temperatures, the first at 133° , at which temperature it changes to a mixture of rhombohedra and rhombic crystals, and the second at 108.5° , where the remaining rhombohedra change to the rhombic form. Although no transition in the conglomerate occurs above 133° , the composition of the two sets of mixed crystals changes with the temperature, the percentage of potassium nitrate being 20 and 50 per cent. at 182° , 20 and

69 per cent. at 133°, and 35 and 84 per cent. at 108.5°. This system thus forms a complete example of the type 4 of transition curve deduced by Roozeboom (preceding abstracts). L. M. J.

Cryoscopic Researches on the Constitution of Acid Amides. By KARL AUWERS [with MAX DOERN] (*Zeit. physikal. Chem.*, 1899, 30, 529—544).—It has been shown that amides in naphthalene solution are generally cryoscopically abnormal (compare Abstr., 1897, ii, 476). The constitution may be either $R \cdot NH \cdot CO \cdot R'$ or $RN \cdot CR' \cdot OH$, and in the latter case the abnormality may be occasioned by the hydroxyl group and the behaviour of the thioamides should be similar to that of the thiophenols. The thiophenols examined, however, were found to be cryoscopically normal, and the thioamides to be abnormal, so that the constitution $R \cdot NH \cdot CS \cdot R'$ is most probable. As, however, the abnormality may be due to the increased acidity of the thio-compounds, the case was further examined. The author shows that in general a substituent causes a decrease of abnormality only when this substituent and the group causing abnormality are attached to neighbouring carbon atoms. In the case of substituted derivatives of benzanilide, it was found that the compounds from ortho-substituted aniline are normal, but the derivatives of the ortho-substituted benzoic acid remain abnormal, and hence the abnormality is caused by an $\cdot NH$ group, that is, the previous conclusions are confirmed. Basic amines are, however, normal, although piperidine is slightly abnormal, and it is found that the abnormality of urethane is greatly decreased by the entrance of a phenyl group. L. M. J.

Accurate Determination of the Molecular Weight of Gases from their Density. By JOHANNES D. VAN DER WAALS (*Proc. K. Akad. Wetensch. Amsterdam*, 1898, 1, 198—201).—The molecular weight of a gas is proportional to the normal density d_n , which is equal to $d_0/(1+a)(1-b)$, where d_0 is the density found at 0° under the pressure p_0 , and a and b are the constants of van der Waals' equation. If d'_0 be the density found at another temperature T , mathematical discussion leads to the equation $d_n/d'_0 = 1 - 0.001645 T_k/T \cdot (27 T_k/8 T - 1)$, where T_k is the critical temperature of the gas. For $T > 27 T_k/8$, the correction is negative, and d_n/d'_0 has a maximum for $T = 27 T_k/4$.

The condition for the observation under a pressure of $\Pi/76$, without the vapour being saturated, is that T must not fall below a certain limit. When this limit is put at $T_k/1.6$, the normal density is 1 per cent. smaller than the value given by experiment. J. C. P.

True Density of Chemical Compound and its Relation to Composition and Constitution. By INNOCENTIVS I. KANONNIKOFF (*Chem. Centr.*, 1899, ii, 858—861; from *J. Russ. Chem. Soc.*, 31, 573—640).—According to the theories of Clausius and Mosotti, the ratio $\mu^2 - 1/\mu^2 + 2$, where μ is the refractive index, is the ratio of the actual volume of the molecules to the total volume; the true density is hence $d(\mu^2 + 2/\mu^2 - 1) = D$, and the value of this constant is the same for liquid and gaseous states. The value being, however, dependent on that of the refractive index, is obviously a function of wave-length and temperature, and may, if required, be corrected for

an infinite wave-length and for zero temperature by the Cauchy dispersion formula and the expression $D^2 = D_0(1 + kt)$. The author, however, employs the values for sodium light and a temperature of from 10° to 20° . If the true density is multiplied by the molecular weight, the product, termed the "molecular density," but of which the physical interpretation does not appear evident, is found to be an additive function. In hydrocarbons, it is given by the expression $39.7n + (2n \pm m)H - 4H + a.9H - b.6H - b'.26H - c.4H$, where n is the number of carbon atoms, $2n \pm m$ that of the hydrogen atoms, and a , b , b' , and c the number of closed chains, ethylenic unions, naphthaleno-ethylenic unions, and acetylenic unions respectively in the molecule, the value for H being 0.967. It is stated that for a large number of compounds the values so calculated are in accord with the determinations. In many cases, the "molecular density" may be a useful criterion of constitution, as the various modes of union have very diverse values, and various examples are given. L. M. J.

Equation of Condition. By MAX REINGANUM (*Chem. Centr.*, 1889, ii, 955; from *Diss. Gottingen*).—Van der Waals' equation can be regarded only as an approximation, but any improvement suggested must still necessitate the law of corresponding states. The author suggests the equation $\{p + a/v^2\}/\{(v - b)^4/v^3\} = RT$; this contains no more constants than van der Waals' expression; the constants also are functions of the molecular weight, and apparent and actual molecular volumes. The author states that it gives results in good accord with previous determinations, notably, those of Young on isopentane, and the validity of the equation is proved by the coincidence of the isothermals, and by the comparison of the predicted and found vapour pressure, expansion of liquid and vapour, and latent heat of vaporisation. The equation predicts the constant ratio between the critical and actual molecular volumes and the constant ratio of the critical density to the theoretical density calculated for a perfect gas, whilst the deduced temperature coefficients of internal friction are also in agreement with the experimental results. L. M. J.

Equilibrium in the System, Water—Phenol—Aniline. By FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 4899, 30, 460—480).—The theoretical aspects of such an equilibrium system are fully considered; in it, two pairs of the components are capable of forming two liquid layers as in the system, water—alcohol—succinonitrile (*Abstr.*, 1898, ii, 564), but the case is now complicated by the existence of a compound of phenol and aniline. In such a case, by the addition of water to the compound, two liquid phases may result in which (1), with or without decomposition, the relative concentrations of the two components of the compound are unchanged, or (2) owing to decomposition, the relative concentrations vary. In the first case, only one temperature occurs at which the compound and the two liquid phases can exist together, but in the second a series of temperatures occur, that is, a "transition interval." This interesting case is observed in the system considered, the compound of phenol and aniline being in equilibrium with two liquid phases between the temperatures

16.9° and 17.2°. The various theoretical and determined equilibrium curves and isothermals are given in the paper (Abstr., 1899, ii, 739).

L. M. J.

False Equilibrium. By MAX BODENSTEIN (*Zeit. physikal. Chem.*, 1899, 30, 567—569).—A reply to Duhem's criticisms of the author's results (see Abstr., 1899, ii, 739).

L. M. J.

Condition of Substances Insoluble in Water formed in Gelatin. By CORNELIS A. LOBRY DE BRUYN (*Proc. K. Akad. Wetensch. Amsterdam*, 1898, 1, 39—42).—The exceptional phenomenon of certain substances, such as silicic acid, remaining unprecipitated in aqueous solution, is general in aqueous gelatin solution. An insoluble compound formed by double decomposition in aqueous solution generally remains unprecipitated when the same substances are brought together in gelatin solution, although there are grounds for believing that the double decomposition has actually taken place. Thus, Cohen has shown that when silver nitrate and potassium bromide are mixed in gelatin solution, the resulting conductivity is that due to the potassium nitrate, and not that due to the two electrolytes, silver nitrate and potassium bromide. Further, although the gelatin solution remains transparent, it takes the colour of the product formed by double decomposition, as in the cases of Prussian blue and lead iodide.

Although the visible precipitation of amorphous substances is prevented by gelatin, crystalline, insoluble substances separate as in aqueous solution: this is the case, for example, with calcium oxalate and ammonium magnesium phosphate.

J. C. P.

Genesis of Dalton's Atomic Theory. By HEINRICH DEBUS (*Zeit. physikal. Chem.*, 1899, 30, 556—562).—A further controversial paper in reply to Kahlbaum (Abstr., 1899, ii, 740).

L. M. J.

Some Anomalies in Mendeléeff's System. By THEODOR H. BEHRENS (*Proc. K. Akad. Wetensch. Amsterdam*, 1898, 1, 148—151).—Isomorphism is not to be rashly used as a guide to the natural position of an element, for the evidence is often conflicting. Retgers, who denies isomorphism between tellurates and sulphates, assigns to tellurium a place in the eighth group between ruthenium and osmium, disregarding the analogy between hydrogen telluride and sulphide, and recognising the isomorphism of K_2TeO_6 with K_2OsO_6 and K_2IrCl_6 . But, on other grounds, tellurium might be put in the fourth group, for the compounds Cs_2TeCl_6 and Cs_2SnCl_6 are isomorphous, and tellurium dioxide dissolves in potassium hydrogen oxalate, forming crystals like those of potassium zirconium oxalate; further, if tellurium should be placed between ruthenium and osmium, seventeen new elements would have to be looked for in that group.

With manganese, there is a similar ambiguity. The isomorphism between $KMnO_4$ and $KClO_4$ agrees with the position of manganese in the seventh group, but, on the other hand, K_2MnO_4 and K_2SO_4 are isomorphous, and experiments made with manganese tetrachloride point to an analogy between manganese and tin.

J. C. P.

Relation of Physical Properties of Elements to their Atomic Weights. By W. SANDER (*Chem. Centr.*, 1899, ii, 955; from *Electr. Zeit.*, 6, 133).—Curves are given in the original paper from which the author deduces that the coefficients of linear expansion, migration velocities of ions, electrical conductivity, and electrolytic potential of metals are periodic functions of their atomic weights.

L. M. J.

Inorganic Chemistry.

Nitrosyl Chloride and its Compounds. By W. J. VAN HETEREN (*Zeit. anorg. Chem.*, 1899, 22, 277—278).—Nitrosyl chloride, when cooled in a mixture of solid carbon dioxide and alcohol, solidifies in blood-red crystals which melt at -65° . It mixes in all proportions with liquid chlorine, and a mixture in the proportions required by the formula NOCl_2 does not crystallise at -80° . The compound, $\text{SnCl}_4 \cdot 2\text{NOCl}$, prepared by treating stannic chloride with nitrosyl chloride and distilling off the excess, melts in a sealed tube at 150° . The compound $2\text{SbCl}_5 \cdot 5\text{NOCl}$ melts in a sealed tube at 180° , and the compound $\text{Fe}_2\text{Cl}_6 \cdot 2\text{NOCl}$ at 116° .

E. C. R.

The Lower Oxides of Phosphorus. By AUGUST MICHAELIS and M. PITTSCH (*Annalen*, 1899, 310, 45—74. Compare Abstr., 1899, ii, 285).—Phosphorus suboxide, P_4O , first obtained by Le Verrier, is precipitated on adding an acid to a solution of phosphorus in alcoholic potash diluted with water; it is also formed on withdrawing the elements of water from hypophosphorous acid by the action of acetic anhydride. It is an orange-red powder of sp. gr. 1.9123 at 26° , but the colour depends largely upon the state of division, being sometimes pale yellow. When thoroughly dried, it is almost odourless, but a trace of moisture imparts to it the odour of phosphine; in the former condition, also, it may be heated in air to a comparatively high temperature without becoming ignited, but when moist it burns readily after being heated at 90° during several hours. If dried and heated in an indifferent gas, phosphorus distils over, leaving phosphoric oxide. Chlorine converts the dried oxide into phosphorus oxychloride and phosphorus pentachloride, the damp substance being oxidised to phosphoric acid, which is also produced by the action of sodium hypochlorite and of warmed sulphuric acid, the latter becoming reduced to hydrogen sulphide. Concentrated nitric acid ignites the substance, which is indifferent towards hydrochloric acid. Many metals are precipitated by it from solutions of their salts either in metallic form, or as phosphorus compounds. A solution of sodium or potassium hydroxide in aqueous alcohol dissolves phosphorus suboxide, forming a deep red solution which transmits only light between the C and D lines of the spectrum; when warmed, or on standing at the ordinary temperature, this solution evolves hydrogen and phosphine, sodium hypophosphite

remaining [dissolved]. The oxide is coloured brown by ammonia, but the latter is removed on exposure to air, and the substance regains its orange-red hue.

The result of the authors' investigation is to show that phosphorus suboxide is the only lower oxide of phosphorus existing at present, those of Gautier, Besson, and Franke being merely Le Verrier's compound in an unpurified condition. An examination of these supposed oxides has been made, and is described in the paper, which gives details of the analytical methods employed [compare Chapman and Lidbury, *Trans.*, 1899, 75, 973]. M. O. F.

A General Property of Phosphorous Acid. By LUDWIG VANINO (*Chem. Centr.*, 1899, ii, 930; from *Pharm. Centr.-H.*, 40, 637—668).—When sodium hydroxide solution is added to a mixture of 10 grams of a 10 per cent. solution of copper sulphate with several grams of phosphorous acid, only a faint turbidity is produced, and this disappears on further addition of the alkali. Under similar conditions, salts of the alkaline earths, cobalt, nickel, and iron (ferrous or ferric) also form clear, alkaline solutions. This property, however, is limited to those metals which form hydroxides, precipitates being formed in the case of salts of such metals as silver or mercury (mercurous or mercuric). These alkaline solutions do not usually form precipitates with sodium carbonate, but often give remarkable reactions with hydrogen sulphide or ammonium sulphide. The alkaline solution of a manganese salt is not at first attacked by hydrogen sulphide, and a similar solution of a ferric salt also resists the action of ammonium sulphide. The copper sulphate solution is not acted on by sodium carbonate or ammonium thiocyanate, but is reduced by a trace of dextrose. Although satisfactory results have not been obtained by analysis, it is probable that in this case, as in the case of arsenious acid, salts such as CuHPO_3 are formed, and that these then combine with sodium phosphate to form double salts. E. W. W.

Fluorohyperborates. By PETR G. MELIKOFF and S. LORD-KIPANIDZE (*Ber.*, 1899, 32, 3349—3354. Compare *Abstr.*, 1898, ii, 219 and 292).—*Potassium fluorohyperborate*, $\text{K}_4\text{B}_4\text{F}_{11}\text{O}_{11} + \text{H}_2\text{O}$, produced by treating an aqueous solution of potassium fluoroborate, $2\text{KF} \cdot \text{B}_2\text{O}_3$, with a slightly alkaline solution of hydrogen peroxide, separates on the addition of alcohol as a viscous mass which becomes crystalline on stirring; the substance is redissolved in water and the process repeated, the salt being finally obtained in rhombic prisms. The following constitution, $\text{OK} \cdot \text{BF} \cdot \text{O} \cdot \text{O} \cdot \text{BF} \cdot \text{O} \cdot \text{OK}, \text{OK} \cdot \text{O} \cdot \text{BF} \cdot \text{O} \cdot \text{O} \cdot \text{BF} \cdot \text{O} \cdot \text{OK}, \text{H}_2\text{O}$, is assigned to the compound. The aqueous solution has an alkaline reaction and slowly evolves oxygen at the ordinary temperature, this decomposition being accelerated by warming; the silver salt is produced as a yellow precipitate by adding silver nitrate to the solution; it is unstable, and blackens owing to the separation of metallic silver, oxygen being simultaneously evolved. The dry potassium salt is moderately stable; dilute sulphuric acid liberates hydrogen peroxide, whilst the concentrated acid evolves ozonised oxygen. This salt may also be obtained by the action of hydrogen peroxide on potassium orthofluoroborate, $\text{BF}(\text{OK})_2$. G. T. M.

Fluorohyperborates. By PETR G. MELIKOFF and S. LORD-KIPANIDZE (*Ber.*, 1899, 32, 3510—3512. Compare preceding abstract).—The potassium salt, $K_2B_2F_5O_6 + H_2O$, to which the structure



is assigned, is precipitated by alcohol from hydrogen peroxide solution as a crystalline powder. The ammonium salt, $Am_2B_2F_5O_6 + 3H_2O$, prepared by adding hydrogen peroxide, ammonia, and alcohol to a solution of boric acid and ammonium fluoride, is a white, crystalline powder, and is moderately stable; the aqueous solution decomposes gradually at ordinary temperatures, and rapidly on warming.

T. M. L.

Explosion of Potassium Chlorate. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1899, 129, 926—929).—Although the decomposition of potassium chlorate into the chloride and oxygen is an exothermic reaction, it is not regarded as an explosive, since it does not detonate when gradually heated. If, however, the melted chlorate be allowed to fall drop by drop into a glass tube heated to redness, a sharp and rather prolonged explosion occurs as each drop comes into contact with the hot tube, a white smoke of potassium chloride being simultaneously formed.

T. H. P.

Acid Iodates Containing Fluorine, and Cesium Fluoroperiodate. By RUDOLPH F. WEINLAND and O. KÖPPEN (*Zeit. anorg. Chem.*, 1899, 22, 256—265).—Cesium hydrogen tetrafluoriodate,



is obtained by dissolving cesium hydrogen iodate, cesium dihydrogen iodate, or cesium dihydrogen iodate with 2 mols. iodic acid in 20—60 per cent. hydrofluoric acid, and also in smaller quantities from a solution of cesium iodate in hydrofluoric acid. It crystallises from 40—60 per cent. hydrofluoric acid in thick, six-sided plates, or aggregates of thin plates, effloresces rapidly on exposure to the air, and dissolves slowly in water, yielding a strongly hydrofluoric acid solution.

Rubidium hydrogen tetrafluoriodate, with $2H_2O$, is obtained by dissolving rubidium fluoride (1 mol.) and iodic acid (2 mols.) in hydrofluoric acid of at least 40 per cent. It crystallises in plates, and is very easily converted into rubidium difluoriodate.

Cesium fluoroperiodate, $2CsIO_4 \cdot 3HF + H_2O$, obtained by dissolving cesium periodate in warm 60 per cent. hydrofluoric acid, crystallises in colourless, lustrous prisms, effloresces slowly on exposure to the air, and is decomposed by water.

E. C. R.

Reversible Reaction between Hydrogen Chloride and Silver. By JOURNALUX (*Compt. rend.*, 1899, 129, 883—886. Compare Abstr., 1879, 589).—The amount of hydrogen chloride formed when silver chloride and hydrogen are heated together increases with the time of heating, and reaches a limit which is dependent on the temperature to which the reacting substances are heated. At a temperature of 350° , equilibrium is established when the residual gas contains 75.85 per cent. of hydrogen chloride, and is attained after heating for 5 weeks, whilst at 600° the limit is reached after heating for 1 hour, and the residual gas contains 92.80 per cent. of hydrogen chloride. The action of hydrogen chloride on silver is also limited and

varies with the temperature. At 490° , 530° , and 600° , equilibrium is established when the residual gas contains 94.10, 92.95, and 92.80 per cent. of hydrogen chloride respectively. The limit at which equilibrium is established is practically independent of the amount of surface of silver chloride exposed, and for temperatures above the melting point of silver chloride this limit is quite independent of mass.

H. R. LE S.

Reciprocal Displacement of Metals. By ALBERT COLSON (*Compt. rend.*, 1899, 129, 825—827).—Experiments with silver and mercurous chloride, and silver and mercuric sulphide in sealed vacuum tubes between 150° and 300° , show that the direct displacement of silver by mercury is, under some conditions, a reversible reaction, limited by the pressure of the mercury vapour, just as heterogeneous dissociation is limited by a gaseous pressure.

Experiments with copper and cadmium sulphide or oxide gave similar, but less definite, results owing to the partial direct dissociation of the two cadmium compounds below 600° . Thin films of cadmium formed by condensation of the vapour in the cool parts of the tube were violet-blue by transmitted light.

C. H. B.

Preparation of Monocalcium Phosphate. By L. LÉON A. PRUNIER and ADOLPHE JOUVE (*J. Pharm.*, 1899, [vi], 10, 529—530).—If a mixture of dicalcium phosphate, $\text{Ca}_2\text{H}_2(\text{PO}_4)_2$, and orthophosphoric acid in the proportions to form monocalcium phosphate, $\text{CaH}_4(\text{PO}_4)_2$, is dissolved in an equal weight of water and the solution rapidly evaporated, a deposit of dicalcium phosphate, sometimes mixed with a little of the monocalcium salt, is obtained; whereas, if the liquid is subjected to prolonged boiling, only hydrated monocalcium phosphate is formed. From these results, it is concluded that the formation of the more stable hydrated monocalcium phosphate from the anhydrous salt is only slowly effected, and this is confirmed by the fact that the pure anhydrous salt only is precipitated when alcohol is added to the freshly prepared solution.

N. L.

Change of Volume during the Hardening of Hydraulic Cements. By HENRI LE CHATELIER (*Compt. rend.*, 1899, 129, 1232—1234).—The author's experiments indicate that the apparent expansion of mortars and cements during hydration is due to the relative displacement of the solid particles, and that in reality this action is accompanied by a considerable diminution in volume.

G. T. M.

Action of Hydrogen Fluoride and Fluorine on Glass. By HENRI MOISSAN (*Compt. rend.*, 1899, 129, 799—804).—Hydrogen fluoride, produced by heating carefully dried potassium hydrogen fluoride, acts at once on very carefully dried glass at the ordinary temperature. Gaseous fluorine obtained by electrolysis, and deprived as far as possible of hydrogen fluoride by passing it over sodium fluoride, acts on glass, but if hydrogen fluoride is completely removed by subjecting the fluorine to the temperature of boiling air, or by passing the gas over dry sodium fluoride cooled in a mixture of solid carbon dioxide and acetone, the fluorine no longer acts on glass, even at 100° , provided that it is dry and the surface is free from

organic matter. If these conditions are satisfied, liquid fluorine can be kept for a long time in sealed glass bulbs or tubes.

The author points out that glass may retain its polish even when acted on by hydrogen fluoride, and that phosphoric oxide cannot be used for drying hydrogen fluoride, owing to the formation of phosphorus oxyfluoride at the ordinary temperature. C. H. B.

Activity of Manganese in Promoting the Phosphorescence of Strontium Sulphide. By JOSÉ R. MOURÉLO (*Compt. rend.*, 1899, 129, 1236—1238. Compare *Abstr.*, 1899, ii, 97, 98, 366, 420, and 484).—The paper contains details of the preparation of phosphorescent strontium sulphide produced by the action of sulphur on strontium carbonate or sulphate at a red heat in the presence of small quantities of manganous sulphate, sodium chloride and sodium carbonate. The effect of the manganous sulphate on the strontium sulphide is similar to that of manganous carbonate or basic bismuth nitrate; the phosphorescence becomes more intense, lasts longer, and is attained after a shorter exposure to diffused daylight. When due to manganese, the phosphorescence has a yellowish-green colour, whilst that produced by bismuth is bluish-green. G. T. M.

Effect of various Solvents on the Allotropic Change of Mercuric Iodide. By J. H. KASTLE and MARY E. CLARK (*Amer. Chem. J.*, 1899, 22, 473—484).—The authors have studied the behaviour of mercuric iodide when dissolved in the following liquids at their boiling point: ethyl bromide, propyl chloride, acetone, ethylidene chloride, ethyl iodide, ethyl acetate, alcohol, isopropyl bromide, benzene, allyl alcohol, toluene, propionitrile, ethyl butyrate, isobutyrate and propionate, benzoic acid, phenol, benzonitrile, oil of winter green, propyl bromide, ψ -cumene, naphthalene and phenyl salicylate; with all these solvents, except isobutyl bromide and propyl chloride, yellow solutions were obtained, and in all cases, without exception, yellow crystals separated on cooling; the pink colour of the solutions obtained with isobutyl bromide and propyl chloride appears to be due, not to the red modification of mercuric iodide, but "to the formation of unstable alkyl iodides." The fact that only yellow solutions are obtained on dissolving the red iodide in the various solvents and that the yellow modification alone separates from these, appears to indicate that the transition temperature (128°) of mercuric iodide is lowered by the solvents dealt with, especially by those boiling at a low temperature. The question whether red mercuric iodide is insoluble in the solvents named, and only dissolves by being converted into the yellow modification, is discussed at some length. It is significant that the red modification is not obtained, but only crystals of the yellow variety, on adding a red crystal to the yellow solutions. W. A. D.

Transformation Temperature of the Quadratic and Orthorhombic Forms of Mercuric Iodide. By DÉSIRÉ GERNEZ (*Compt. rend.*, 1899, 129, 1234—1236).—Yellow mercuric iodide may be kept for a long time at the ordinary temperature, whilst the red variety persists at temperatures above that at which transformation is possible; the former state of the iodide is termed "crystalline superfusion,"

and the latter "crystalline superheating." On account of these retardations, it is difficult to determine the transformation temperature with exactness. When alternate layers of the two forms, placed in contact with each other, are maintained at the same temperature, it is found that at 127° the zones of yellow iodide slowly encroach on the red variety, whilst at 125° this modification gradually displaces the other. The transformation temperature is therefore 126° and is the same whether the crystals are heated under atmospheric pressure or in a vacuum.

G. T. M.

Dissociation by Water of Ammonium and Potassium Mercuriodides. By MAURICE FRANÇOIS (*Compt. rend.*, 1899, 129, 959—962. Compare Abstr., 1899, ii, 597).—In the presence of relatively large quantities of water, these salts suffer complete decomposition into the constituent iodides, part of the mercuric iodide being precipitated and the rest forming a saturated solution in the alkali iodide solution. By treatment of the mercuriodides with small quantities of water, as also by acting on excess of mercuric iodide with solutions of the alkali iodides, it is found that the decomposition is limited and reversible, and obeys the laws of dissociation of salts by water; when equilibrium is attained, the liquid contains a quantity of free ammonium or potassium iodide, which is constant for a given temperature.

T. H. P.

Preparation of Sulphur, Chlorine, and Bromine Compounds of the Cerite Metals. By WILHELM MUTHMANN and L. STÜTZEL (*Ber.*, 1899, 32, 3413—3419).—Didier's method of preparing cerium and lanthanum sulphides, by passing hydrogen sulphide over the heated oxides (Abstr., 1885, 955), does not give satisfactory results unless the oxide is very finely powdered; the pure sulphides can, however, be readily obtained if the anhydrous sulphates are used. The cerium sulphide is brownish-black to black, lanthanum sulphide is pure yellow, neodymium sulphide is olive-green, and praseodymium sulphide is chocolate-coloured. They are fairly stable in air at the ordinary temperature, but are slowly decomposed by boiling water with evolution of hydrogen sulphide (lanthanum sulphide the most readily), and dissolve readily in dilute acids; the four sulphides ignite readily below a red-heat and burn to a mixture of oxide and sulphate, and cerium sulphide when finely divided ignites spontaneously at the ordinary temperature. Mosander's greenish cerium oxysulphide and golden-yellow, crystalline sulphide could not be prepared. The densities are La_2S_3 , 4.9108; Ce_2S_3 , 5.020; Pr_2S_3 , 5.042; Nd_2S_3 , 5.179 at 11° , increasing with the atomic weight.

The chlorides are prepared by first passing hydrogen sulphide over the dry sulphates, then carbon dioxide and dry hydrogen chloride. Cerium and lanthanum chlorides are pure white, crystalline masses, neodymium chloride is rose-coloured, and praseodymium is green. They readily absorb moisture from the air, dissolve with hissing in water to a clear solution, dissolve in alcohol and are readily fusible, but only volatilise with great difficulty. For preparing large quantities of chloride containing a trace of oxide, the best method is by evaporation and ignition of the ammonium double chloride.

By passing hydrogen bromide over the sulphide, cerium bromide, CeBr_3 , was obtained as a snow-white, crystalline, soluble powder, which readily absorbed moisture from the air. T. M. L.

Specific Gravity of Yttrium, Zirconium, and Erbium. By STEFAN MEYER (*Monatsh.*, 1899, 20, 793—796).—Investigations of magnetic susceptibility have shown that the paramagnetic element yttrium occupies a position in the periodic system among a number of diamagnetic elements, and this peculiarity has led the author to determine some other characteristic constant. The specific gravity of yttrium powder was measured in a volumometer, the powder being contained in a small tube connected through a ground stopper with the rest of the apparatus. The specific gravity was found to be 3.80 at 15° ; with the atomic weight 89, the atomic volume is thus 23.6, a value corresponding with the position already assigned to yttrium in the periodic system. The abnormal magnetic behaviour of this element is therefore probably due to an admixture of some known or unknown element; if the presence of the new element victorium in yttrium should be confirmed, the former must be strongly paramagnetic.

The specific gravity of zirconium has been found to be 4.08, and that of erbium 4.77 at 15° . J. C. P.

Direct Combination of Aluminium and Nitrogen in the Electric Arc. By LEO ARONS (*Chem. Centr.*, 1899, ii, 643; from *Naturw. Rundsch.*, 14, 453—454).—When an electric arc is produced between electrodes of platinum, zinc, copper, tin, lead, iron, or cobalt in an atmosphere of nitrogen, the surface of the metal becomes coated with a film which probably consists of nitride. In the case of aluminium, considerable quantities of the greyish-black nitride are formed. This nitride is insoluble in water, and when treated with potassium hydroxide solution yields ammonia. When silver electrodes are used, the appearance of the silver changes, but there is apparently no formation of nitride. The analogy between the production of nitrides and that of acetylene by means of the arc, and the importance of utilising the nitrogen of the atmosphere are pointed out.

E. W. W.

Double Salts of Ferric and Aluminium Fluorides with Fluorides of Bivalent Metals. By RUDOLPH F. WEINLAND and O. KÖPPEN (*Zeit. anorg. Chem.*, 1899, 22, 266—276).—These salts are prepared by mixing a solution of aluminium or ferric hydroxide in dilute hydrofluoric acid with a solution of the carbonate or hydroxide of the bivalent metal in dilute hydrofluoric acid, and allowing the mixture to evaporate at the ordinary temperature over lime. An excess of one of the constituents and the amount of hydrofluoric acid present are immaterial. The salts can be recrystallised from dilute hydrofluoric acid.

Ferric ferrous fluoride, $\text{FeF}_3 \cdot \text{FeF}_2 + 7\text{H}_2\text{O}$, forms yellow, rhomboidal crystals and does not effloresce over sulphuric acid. *Ferric nickel fluoride*, $\text{FeF}_3 \cdot \text{NiF}_2 + 7\text{H}_2\text{O}$, separates in small, bright green crystals, *ferric cobalt fluoride* in rose-coloured crystals, and *ferric zinc fluoride* in very small, faintly red crystals.

Aluminium ferrous fluoride, $\text{AlF}_3 \cdot \text{FeF}_2 + 7\text{H}_2\text{O}$, forms small, greenish-white, rhomboidal crystals, does not oxidise on exposure to the air or effloresce when placed over sulphuric acid. The corresponding *nickel* salt separates in green crystals, the *cobalt* salt in reddish-white crystals, and the *zinc* salt in colourless crystals.

Aluminium fluoride combines with copper fluoride to form three double salts. The salt, $\text{AlF}_3 \cdot 2\text{CuF}_2 + 11\text{H}_2\text{O}$, obtained from solutions containing 1 mol. aluminium fluoride to 2 or more mols. copper fluoride, crystallises in spherical aggregates of blue leaflets and does not effloresce over sulphuric acid. The salt, $2\text{AlF}_3 \cdot 3\text{CuF}_2 + 18\text{H}_2\text{O}$, crystallises in deep blue prisms resembling feldspar from solutions containing 2 mols. aluminium fluoride to 3 mols. copper fluoride in the presence of only small quantities of hydrofluoric acid. If much acid is present, the salt, $\text{AlF}_3 \cdot \text{CuF}_2 \cdot \text{HF} + 8\text{H}_2\text{O}$, is formed; this crystallises in large, blue rhombohedra from solutions containing 1 mol. aluminium fluoride to 1 mol. or less of copper fluoride and an excess of hydrofluoric acid, and effloresces rapidly on exposure to the air with evolution of water and hydrofluoric acid.

E. C. R.

Action of Nitric Oxide on Chromyl Dichloride. By VICTOR THOMAS (*Compt. rend.*, 1899, 129, 828—831).—Nitric oxide acts violently on chromyl dichloride with abundant formation of higher nitrogen oxides. If the chromium compound is in the form of vapour, the solid product is at first white, but afterwards becomes brown; it is very slightly soluble in organic solvents, but dissolves readily in water with liberation of nitrogen oxides and production of a black solution containing chromic oxide, chromic acid, chlorine, and nitrogen oxides. This solid product has the composition $\text{Cr}_5\text{Cl}_5\text{O}_7 \cdot 2\text{NO}_2$; when heated, it yields chromic oxide, nitrogen oxides, and chlorine, and when treated with reducing agents the nitrogen is converted into ammonia. Chromium, like tin, bismuth, and iron, can evidently form compounds containing the NO_2 group, which are stable even in a vacuum at the ordinary temperature, but are readily decomposed by water.

C. H. B.

Molybdenum Disulphide. By MARCEL GUICHARD (*Compt. rend.*, 1899, 129, 1239—1242).—Crystalline molybdenum disulphide is readily prepared by heating a mixture of potassium carbonate, sulphur, and molybdenum dioxide or ammonium molybdate in the Perrot furnace. The amorphous sulphide is produced by heating a mixture of ammonium molybdate and sulphur in an earthenware crucible surrounded by lampblack, the operation being repeated to remove the last traces of oxygen from the product. The sulphide is not attacked by solutions of sulphur in alkaline hydrosulphides or sulphur chloride, and phosphorus is without action on it even at high temperatures. When heated in a current of hydrogen, it is directly reduced to the metal without forming a lower sulphide. Although native molybdenite loses the whole of its sulphur at the temperature of the electric arc, it is possible in the case of the artificial product to isolate an intermediate sesquisulphide.

G. T. M.

Molybdenum Silicide. By ÉMILE VIGOUROUX (*Compt. rend.*, 1899, 129, 1238—1239).—*Molybdenum silicide*, Mo_2Si_2 , resembles tungsten

silicide (Abstr., 1899, ii, 194), and is prepared in a similar manner by heating, in a carbon crucible in the electric furnace, a mixture of crystallised silicon and the molybdenum oxides obtained by calcining ammonium molybdate; the crystalline product is disintegrated by electrolysis in hydrochloric acid, and the mixture of crystalline silicides is treated successively with aqua regia, caustic potash, and hydrofluoric acid; the removal of carbon silicide is effected by means of cadmium tungstate solution, and the residue consists of molybdenum silicide mixed with more or less iron silicide. When heated in chlorine at 300° , molybdenum silicide becomes ignited, silicon tetrachloride and molybdenum perchloride being produced.

G. T. M.

Complex Inorganic Acids. VIII. Arsenoduodecitungstic Acid and Arsenoluteotungstic Acid. By FRIEDRICH KEHRMANN and E. RÜTTIMANN (*Zeit. anorg. Chem.*, 1899, 285—296).—Ammonium arsenoduodecitungstate, $3(\text{NH}_4)_2\text{O} \cdot \text{As}_2\text{O}_5 \cdot 24\text{WO}_3 + 12\text{H}_2\text{O}$, obtained by adding arsenic acid to a concentrated aqueous solution of sodium tungstate, then adding hydrochloric acid in excess and ammonium chloride, and heating to boiling, is a snow-white, crystalline powder resembling the analogous phosphorus compound. A solution of the acid is obtained by dissolving the salt in aqua regia, but decomposes on evaporation. When boiled with a 5 per cent. solution of ammonium carbonate, it is converted into the 22-acid and on adding barium chloride to the solution the barium salt, $7\text{BaO} \cdot \text{As}_2\text{O}_5 \cdot 22\text{WO}_3$, separates in small, lustrous octahedra.

Ammonium arsenoluteotungstate, $3(\text{NH}_4)_2\text{O} \cdot \text{As}_2\text{O}_5 \cdot 18\text{WO}_3 + 14\text{H}_2\text{O}$, obtained by heating sodium tungstate with a syrupy solution of arsenic acid and precipitating with solid ammonium chloride, crystallises in monoclinic, lemon-yellow prisms and is very soluble in cold water. When treated with ammonium carbonate, it is converted into the salt $5(\text{NH}_4)_2\text{O} \cdot \text{As}_2\text{O}_5 \cdot 17\text{WO}_3 + 8\text{H}_2\text{O}$, which crystallises in thick, white, semi-transparent crystals, and is decomposed by boiling with water with evolution of ammonia.

Potassium arsenoluteotungstate, when treated with potassium hydrogen carbonate, yields the salt $5\text{K}_2\text{O} \cdot \text{As}_2\text{O}_5 \cdot 17\text{WO}_3 + 22\text{H}_2\text{O}$, which crystallises in lustrous, white leaflets, and is not decomposed by boiling with water.

E. C. R.

Antimonic Acid and Antimonates. By A. E. DELACROIX (*Bull. Soc. Chim.*, 1899, [iii], 21, 1049—1054. Compare Abstr., 1898, ii, 340).—The two soluble antimonic acids, the existence of which in solution has previously been demonstrated, are more suitably termed tetra-antimonic and triantimonic acids instead of pyroantimonic and orthoantimonic acids respectively.

Tetra-antimonic acid is obtained, by freezing its aqueous solution, in the form of thin, optically active scales having the composition $\text{Sb}_2\text{O}_5 \cdot 4\text{H}_2\text{O}$, or, when dried over sulphuric acid, $\text{Sb}_2\text{O}_5 \cdot 3\text{H}_2\text{O}$; a further H_2O is lost at 100° . It forms both monobasic and dibasic salts of the composition $\text{M}_2\text{O} \cdot 4\text{Sb}_2\text{O}_5$ and $\text{M}_2\text{O} \cdot 2\text{Sb}_2\text{O}_5$, respectively. The alkali salts are soluble in water, but not in solutions of other salts, and are prepared by adding to a solution of the acid the theoretical amount of alkali hydroxide or acetate, and freezing the liquid, when

the salts are obtained in the crystalline form; the dibasic alkali salts are precipitated in an amorphous state by adding alcohol to their solutions. The other tetra-antimonates are obtained by double decomposition from the metallic acetates, and are insoluble in water. The following salts have been prepared; some of them, the dibasic sodium salt, for instance, are decomposed by water, with the production of monobasic and dibasic triantimonates. $\text{Na}_2\text{O}, 2\text{Sb}_2\text{O}_5 + 9\text{H}_2\text{O}$; $\text{Na}_2\text{O}, 4\text{Sb}_2\text{O}_5$; the mixed salt, $\text{Na}_2\text{O}, 4\text{Sb}_2\text{O}_5, \text{Na}_2\text{O}, 2\text{Sb}_2\text{O}_5 + 20\text{H}_2\text{O}$; $\text{K}_2\text{O}, 2\text{Sb}_2\text{O}_5 + 9\text{H}_2\text{O}$; $\text{BaO}, 2\text{Sb}_2\text{O}_5 + 5\text{H}_2\text{O}$; $\text{BaO}, 4\text{Sb}_2\text{O}_5 + 15\text{H}_2\text{O}$; $\text{CuO}, 2\text{Sb}_2\text{O}_5 + 9\text{H}_2\text{O}$, a green salt which dissolves in ammonia to form a double salt crystallising in hexagonal prisms. Tetra-antimonates of silver, cadmium, mercury, nickel, and cobalt have also been obtained; the nickel and cobalt salts form respectively red and blue double salts with ammonia.

Triantimonic acid is obtained, by freezing its solution, in crystals of the composition $\text{Sb}_2\text{O}_5, 3\text{H}_2\text{O}$, which lose $1\text{H}_2\text{O}$ when dried over sulphuric acid. It forms salts of the types $\text{M}_2\text{O}, 3\text{Sb}_2\text{O}_5$, $2\text{M}_2\text{O}, 3\text{Sb}_2\text{O}_5$, and $3\text{M}_2\text{O}, 3\text{Sb}_2\text{O}_5$, besides other more complex derivatives, which are prepared by methods similar to those employed in the preparation of tetra-antimonates. The alkali salts only are soluble in water, those containing one equivalent of the base being also soluble in alcohol. The following triantimonates have been obtained: $2\text{Na}_2\text{O}, 3\text{Sb}_2\text{O}_5 + 10\text{H}_2\text{O}$; $\text{Na}_2\text{O}, 3\text{Sb}_2\text{O}_5 + 11\text{H}_2\text{O}$; $2\text{K}_2\text{O}, 3\text{Sb}_2\text{O}_5 + 10\text{H}_2\text{O}$; $\text{BaO}, \text{Sb}_2\text{O}_5 + 2\text{H}_2\text{O}$; $\text{BaO}, 3\text{Sb}_2\text{O}_5 + 5\text{H}_2\text{O}$; $9\text{BaO}, 10\text{Sb}_2\text{O}_5 + 18\text{H}_2\text{O}$; $2\text{CuO}, 3\text{Sb}_2\text{O}_5 + 10\text{H}_2\text{O}$; $\text{CuO}, 6\text{Sb}_2\text{O}_5 + 16\text{H}_2\text{O}$.

The antimonic acid described by Senderens (Abstr., 1899, ii, 557) is believed to be a mixture of tri- and tetra-antimonic acids. N. L.

Sesquichlorides of Rhodium and Iridium. By ÉMILE LEIDITZ (*Compt. rend.*, 1899, 129, 1249—1251).—Anhydrous rhodium sesquichloride is most conveniently prepared by dissolving in water the crude double salt, $\text{Rh}_2\text{Cl}_6, 6\text{NaCl}$, obtained by treating the metal with chlorine in the presence of sodium chloride, saturating the solution with hydrogen chloride, and after removing the precipitated sodium chloride, evaporating to dryness and heating the residue at $360\text{--}440^\circ$ in a stream of chlorine or hydrochloric acid. The anhydrous chloride forms a brown powder insoluble in water and acids; it dissolves in solutions of the alkalis, potassium cyanide, alkali tartrates, and oxalates. The double salts of iridium sesquichloride, $\text{Ir}_2\text{Cl}_6, 6\text{KCl} + 6\text{H}_2\text{O}$ and $\text{Ir}_2\text{Cl}_6, 6\text{NaCl} + 20\text{H}_2\text{O}$, are much more stable than the corresponding rhodium compounds, and are not completely decomposed even at 440° . The ammonium salt, $\text{Ir}_2\text{Cl}_6, 6\text{NH}_4\text{Cl} + 3\text{H}_2\text{O}$, like its rhodium analogue, undergoes a complex secondary reaction and cannot be employed in obtaining the sesquichloride. Iridium sesquichloride is best produced from the double salt, $\text{IrCl}_4, 2\text{NH}_4\text{Cl}$; it is a dark green substance insoluble in acids and alkalis. G. T. M.

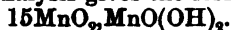
Mineralogical Chemistry.

Composition of Naphtha from Grosny. By K. W. CHARITSCHKOFF (*Chem. Centr.*, 1899, ii, 920; from *J. Russ. Chem. Soc.*, 1899, 31, 655—658. Compare this vol, i, 74).—The naphtha of Grosny contains thiophen in the proportion of about 1 part in 10,000,000 of "benzine," and mercaptan and thio-esters are also present. The decrease in sp. gr. of the "benzine" fraction is also assumed to indicate the presence of large quantities of isoeptane (*loc. cit.*). The fractions boiling at 29—30° have a composition corresponding with that of a mixture of two isomeric pentanes. By the action of nitrosulphuric acid on the fraction boiling at 82—89°, dinitrobenzene is formed, this compound being derived from tetrahydrobenzene. The Grosny naphtha contains the same compounds as American naphtha, but in different proportions. E. W. W.

Texas Petroleum. By F. C. THIELE (*Amer. Chem. J.*, 1899, 22, 489—493).—Petroleum from Corsicana and from Sour Lake, Texas, was submitted to fractional distillation. The results obtained show that the Corsicana oil is closely related to Pennsylvania oils, especially that of the Washington district, but it contains a certain amount of asphaltum, and hence care is necessary in distilling it. The greater part of the Sour Lake oil, which is a "surface oil," consists of oils excellently suited for lubricating purposes, the last fraction having a viscosity of 19° (Engler apparatus); it contains 20 per cent. of asphaltum. W. A. D.

Analyses of Moravian Minerals. By FRANTIŠEK KOVÁŘ (*Jahrb. f. Min.*, 1900, i, Ref. 25; from *Zeit. Chem. Ind. Prag.*, 1898, 4 pp.).—Graphite from Klein-Tressny contains, according to two determinations on different samples, 39·60 and 42·35 per cent. of carbon; the remainder is ash with about 1·5 per cent. of water.

Pyrolusite from Stěpánovitz occurs as nodules in red clay, which fills cavities in limestone; analysis gives the formula



Analyses are also given of dolomitic limestone and of a fireproof clay. L. J. S.

Magnetite from near Rome. By FERRUCCIO ZAMBONINI (*Jahrb. f. Min.*, 1900, i, Ref. 9; from *Rivista min. crist. ital.*, 1898, 21, 21—35).—A description is given of the fine crystals of magnetite occurring in lava at the quarries of Acquacetosa and Tavolato, near Rome. Sp. gr. 5·04—5·11. Analyses gave I for grains and II for crystals.

	Fe ₂ O ₃	FeO.	TiO ₂	MgO.	Total.
I.	69·5	28·7	0·9	0·7	99·8
II.	70·2	28·9	0·6	0·7	100·4

L. J. S.

Auriferous Cobalt Ores in the Transvaal. By H. OEHMICHEN (*Chem. Centr.*, 1899, ii, 788; from *Zeit. prakt. Geol.*, 1899, 271—274).—Auriferous smaltite occurs as veins in diabase at Kruis River and Laatsch Drift. L. J. S.

Fluorine in Swedish Phosphorites. By J. G. ANDERSSON and N. SAHLBOM (*Bull. Geol. Inst. Univ. Upsala*, 1899, (1898), 4, 79—87).—Analyses of phosphorites from various Swedish localities are given; some show the presence of fluorine in the proper proportion for fluorapatite. The phosphorites occur in fossiliferous strata and have been derived from organic remains. Analyses of fossil and recent brachiopod shells show them to consist largely of calcium phosphate with some fluorine.
L. J. S.

Analyses of Moravian Minerals. By FRANTIŠEK KOVÁŘ (*Jahrb. f. Min.*, 1900, i, Ref. 23; from *Chem. Blätter, Prag*, 1899, 4 pp.).—The minerals analysed are from Wür, near Bistritz. The primitive limestone gave I for the pure white, and II for the grey-white, variety.

	CaCO ₃	MgCO ₃	(Fe, Al) ₂ O ₃	Insol. in HCl.	H ₂ O.	Total.
I.	93·21	2·35	0·29	3·84	0·18	99·87
II.	92·08	3·16	0·70	3·98	0·24	100·16

A compact, white to bluish-grey substance resembling halloysite in appearance is shown by analysis III to be kaolinite.

Melinite [?] is compact, ochre-yellow and opaque; the fracture is earthy and the streak shining; analysis gave the results under IV, agreeing with the formula $H_4AlFeSi_2O_6$.

Sphene, as small honey-yellow crystals in the primitive limestone, gave V.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	CaO.	MgO.	H ₂ O.	Total.	Sp. gr.
III.	45·72	—	38·80	0·29	—	0·90	0·18	14·36	100·25	2·03
IV.	46·30	—	26·42	15·32	—	0·25	—	12·08	100·37	2·17
V.	32·55	41·58	—	—	0·84	25·41	—	—	100·38	3·48

L. J. S.

Analyses of Moravian Minerals. By FRANTIŠEK KOVÁŘ (*Jahrb. f. Min.*, 1900, i, Ref. 24; from *Rozpravy České Akad. [Memoirs Bohemian Acad.]*, 1898, 7, class II, No. IX, 8pp.).—Limonite as a botryoidal coating, from near Gross-Tressny, gave analysis I.

Gymnite occurs as small veins in limestone at Gross-Tressny; it is yellow and has a resinous lustre; analysis II gives the formula $Mg_3Si_2O_{10} + 5H_2O$.

Turgite encrusts bog-iron-ore at Rovečín near Öls; it is black and has a dark red streak; analysis III (also MnO, 0·96; SO₃ trace) gives the usual formula, $2Fe_2O_3 + H_2O$.

Vivianite occurs as dark blue aggregates of minute needles in cavities of the bog-iron-ore at Rovečín. Analysis IV (also insoluble 0·97), gives the formula $18FeO, 3Fe_2O_3, 8P_2O_5 + 56H_2O$.

	P ₂ O ₅	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	CaO.	MgO.	H ₂ O.	Total.	Sp. gr.
I.	1·32	2·48	0·17	81·78	—	0·37	—	18·75	99·77	3·172
II.	—	41·17	0·18	0·76	—	trace	36·32	21·46	99·89	1·972
III.	0·12	2·05	0·29	92·07	—	0·18	—	4·89	100·56	4·315
IV.	38·51	—	trace	12·04	32·70	trace	—	25·43	99·65	2·637

L. J. S.

Analyses of Moravian Minerals. By FRANTIŠEK KOVÁŘ (*Jahrb. f. Min.*, 1900, i, Ref. 24; from *Zeit. Chem. Ind. Prag*, 1898, 4 pp.).—Whitish-grey kaolinite ("Steinmark") from the graphite mines at Klein-Tressany gave I; formula $2R'''_2Si_3O_9 \cdot R''SiO_3 + 2H_2O$.

Straw-yellow saponite filling cavities in the kaolinite is a plastic substance which falls to powder when exposed to the air. Anal. II gives the formula $Al_2Si_2O_7 \cdot 9MgSiO_3 + 9H_2O$.

Dull-green celadonite occurs as veins in the kaolinite. Anal. III, formula $R'''_2Si_3O_9 \cdot 4R''SiO_3 + 5H_2O$.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	CaO.	MgO.	(K,Na),O.	H ₂ O.	Total.	Sp. gr.
I. 57.74	28.50	1.56	—	2.07	2.35	3.21	5.06	100.49	2.428	
II. 51.42	7.60	0.59	—	0.43	28.15	0.24	12.07	100.50	—	
III. 47.52	5.14	9.01	21.33	1.77	1.14	3.18	10.49	99.58	2.796	

L. J. S.

Solidification of Fused Silicates under High and Normal Pressure. By C. F. W. A. OMTLING (*Zeit. Kryst. Min.*, 1899, 32, 179; from *Tech. Min. Mitth.*, 1897, 17, 331—373).—Since natural magmas must in most cases have solidified under high pressures, several comparative experiments were made to observe the effect of pressure on the crystallisation of silicate fusions.

In the experiments, the following crystallised minerals were formed: corundum, graphite, magnetite, spinel, pyroxene, plagioclase, and melilite.

L. J. S.

Olivine from Latium. By FERRUCCIO ZAMBONINI (*Zeit. Kryst. Min.*, 1899, 32, 152—156).—A crystallographic description is given of olivine from the lavas, &c., of Latium. An analysis gave:

SiO ₂	FeO.	Al ₂ O ₃	MgO.	NiO.	Total.	Sp. gr.
40.39	8.81	0.35	49.73	0.12	99.40	3.41

L. J. S.

[**Mineral Analyses.**] By VASILE C. BUTUREANU (*Zeit. Kryst. Min.*, 1899, 32, 188; from *Bull. Soc. Sci. Bucaresti*, 1897, 6, 264—293).—The following mineral analyses are given in a petrological paper on the eruptive rocks of Suzeava: I, oligoclase from syenite; II, oligoclase-andesine from miascite; III, orthoclase from ditroite; IV, biotite from syenite; V, biotite from miascite; VI, hornblende from miascite; VII, sodalite from ditroite.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	CaO.	MgO.	K ₂ O.	Na ₂ O.	Cl.	Loss on ignition.
I. 61.68	23.95	—	—	5.25	0.16	1.09	6.99	—	1.05
II. 60.28	22.40	—	—	1.17	0.09	6.37	8.44	—	1.61
III. 66.23	18.12	—	—	0.30	—	9.90	5.02	—	0.29
IV. 42.25	19.79	6.68	15.34	2.55	2.56	7.88	2.01	—	1.43
V. 34.66	12.55	15.47	21.37	1.39	1.59	8.56	2.24	—	2.62
VI. 37.19	13.38	—	29.36	10.98	3.03	2.65	2.25	—	1.08
VII. 38.99	32.85	—	—	0.80	—	0.86	24.57	0.14	1.78

L. J. S.

Two New Hydrosilicates. By FERRUCCIO ZAMBONINI (*Zeit. Kryst. Min.*, 1899, 32, 157—163).—*Müllerite*. This occurs as a yellowish-green coating on iron and manganese oxides from Nontron, Dept.

Dordogne, France. It is soft, compact and opaque, and resembles nontronite ($\text{Fe}_2\text{O}_3, 3\text{SiO}_2 + 5\text{H}_2\text{O}$) in appearance, but differs from this in the blowpipe reactions and in containing less water. The mean (I) of three analyses gives the formula $\text{Fe}_2\text{O}_3, 3\text{SiO}_2 + 2\text{H}_2\text{O}$. Some previous analyses of nontronite and other varieties of chloropal show considerable variations in composition. [The name müllerite is already in use.]

Melite. This is from Sealfeld, Thuringia, and forms an aggregate of imperfect prismatic crystals and stalactitic masses. It is bluish-brown, opaque and brittle; $\text{H}=3$. Analysis gave the results under II. Encrusting this mineral are small, snow-white spheres, which are shown by analysis III to be schrötterite. [The name melite is likely to be confused with mellite.]

	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	MnO	H_2O	Total	Sp.gr.
I.	48.82	35.88	4.30	—	0.35	0.63	9.66	99.64	1.97
II.	14.97	14.90	35.24	0.78	—	—	33.75	99.64	—
III.	12.56	0.81	43.77	0.95	—	—	41.56	99.65	2.18

L. J. S.

Analyses of Sandstone Concretions. By CHARLES C. MOORE (*Proc. Liverpool Geol. Soc.*, 1898, 8, 241—265).—Analyses are given of concretions in Bunter sandstone from West Cheshire. L. J. S.

Phyllades and Slates. By T. MELLARD READE and PHILIP HOLLAND (*Proc. Liverpool Geol. Soc.*, 1898, 8, 274—293).—The phyllades of the Ardennes are compared with the slates of North Wales; several analyses of these, and of slates from other localities, are given.

L. J. S.

Vanadium in Rocks. By J. H. L. VOGT (*Chem. Centr.*, 1899, ii, 783; from *Zeit. prakt. Geol.*, 1899, 274—277).—From Hillebrand's analyses (*Abstr.*, 1899, ii, 112), the average amount of vanadium in the earth's crust is calculated to be between 0.0025 and 0.005 per cent.

L. J. S.

Rocks from Sumatra. By LUDWIG MILCH (*Chem. Centr.*, 1899, ii, 789; from *Zeit. Deutsch. geol. Ges.*, 1899, 51, 62—74).—In a paper describing the recent volcanic rocks of the Battak table-land in Central Sumatra, the following analyses by W. Herz are given: I, liparite; II, dacite; III, quartz-trachyte-andesite; IV, trachyte-andesite.

	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	H_2O	Total
I.	71.25	14.21	0.85	0.43	2.72	0.89	6.74	3.11	0.48	100.68
II.	66.71	15.82	0.71	0.32	3.92	2.05	2.42	7.12	1.01	100.08
III.	69.44	15.21	1.74	0.56	1.99	0.93	4.53	5.11	0.77	100.28
IV.	60.41	17.44	1.98	1.78	2.79	1.85	5.64	7.51	0.51	99.91

L. J. S.

Meteoric Iron from Iredell, Texas. By WARREN M. FOOTE (*Amer. J. Sci.*, 1899, [iv], 8, 415—416).—This iron, originally weighing about three pounds, was found in 1898 near Iredell, Bosque Co., Texas. It differs from other Texas irons in the fine pitting and the absence of Widmanstätten figures on an etched sur-

face. Analysis by J. E. Whitfield of material partially freed from schreibersite gave :

Fa.	Ni.	Co.	P.	S.	Total
93.75	5.51	0.52	0.20	0.06	100.04

L. J. S.

Analyses of Glacial Deposits and Waters. By PHILIP HOLLAND and EDMUND DICKSON (*Proc. Liverpool Geol. Soc.*, 1898, 8, 130—150).—Analyses are given of mud and other glacial deposits and of glacial waters from the neighbourhood of the Varanger Fjord in Arctic Norway.

L. J. S.

Physiological Chemistry.

Influence of some Alcohols of Simple or Complex Function on the Digestion of Proteids by Pepsin or Trypsin. By E. LABORDE (*J. Pharm.*, 1899, [vi], 10, 484—488).—The influence on peptic and pancreatic digestion of the presence of 0.5 and 2 per cent. of alcohol and other substances was determined by digesting coagulated albumin with pepsin or trypsin for 3—4 hours at 40°, estimating the albumoses and peptones produced, and comparing the results with those obtained in blank experiments carried out under similar conditions. Peptic digestion appears to be favoured by small quantities of isobutyl alcohol, glycerol, and malic acid, and also, although very slightly, by methyl alcohol, whilst ethyl and propyl alcohols, lactic and tartaric acids, mannitol and dextrose distinctly retard digestion. Pancreatic digestion is aided by methyl and isobutyl alcohols, glycerol and dextrose, whilst a retarding action is exhibited by ethyl and propyl alcohols, lactic, malic, and tartaric acids, and mannitol.

N. L.

Proteid Metabolism. By A. ALBU (*Chem., Centr.*, 1899, ii, 395; from *Fortis. Med.*, 17, 505—508).—Caseon, the name given to a preparation of milk-proteid, is recommended in cases of malnutrition. Its absorption and utilisation compare favourably with those of other proteids. By giving a high percentage of proteid in the diet, a person can hold back proteid in the body, so that at the end of the research he is not in nitrogenous equilibrium, although the increase of body weight is not correspondingly high.

W. D. H.

Nitrogenous Metabolism in the Cat. By LAFAYETTE B. MENDEL and ERNEST W. BROWN (*Amer. J. Physiol.*, 1900, 3, 261—270).—Kynurenin acid is not excreted by the cat even during the increased proteid metabolism produced by the administration of phloridzin. The ingestion of thymus and pancreas causes a marked increase of the uric acid output as in man and dog. Excretion of allantoin is also observed after thymus and pancreas feeding or after uric acid

ingestion; it was not observed after administration of hydrazine sulphate. The ordinary daily uric acid output per kilo. of body weight in the cat is scarcely smaller than in man and dog. Creatinine is ordinarily present in cat's urine in noticeable quantity.

W. D. H.

Comparative Determinations of the Specific Gravity, Dry Residue, and Amount of Iron in Blood. By S. JELLINEK and FR. SCHIFFER (*Chem. Centr.*, 1899, ii, 721; from *Wien klin. Woch.*, 12, 802—805).—Ordinary healthy blood has a sp. gr. 1·060—1·065, leaves 22·26—23·94 per cent. of dry residue, and contains 0·0431—0·0527 per cent. of iron. The iron was estimated by the ferrometer. The blood of patients suffering from various diseases was also examined. The various constants of the blood of healthy beings were found to maintain a certain relationship, and in other cases the sp. gr. and percentage of dry residue seemed also to be connected.

E. W. W.

Cerebro-spinal Fluid. By THEODOR PANZER (*Chem. Centr.*, 1889, ii, 722; from *Wien klin. Woch.*, 12, 805—807. Compare Nawratzki, *Abstr.*, 1898, ii, 36).—The cerebro-spinal fluids of two children had sp. gr. 1·0086 and 1·00917 respectively, and were faintly alkaline; the latter contained a hexose. Both fluids contained cholesterol, neutral fat and soaps, but albumoses, peptones, enzymes, and urea were not present in either. The fluid of the lower sp. gr. was found to contain 15·97 grams of solid substances, 7·34 of organic compounds, 8·63 of mineral substances, 1·404 of nitrogen, 5·99 of proteid substances (total), 4·85 of albumin, and 1·14 of globulin per litre. Analyses of both fluids are given.

E. W. W.

Hydrocele Fluid. By VERTUN (*Chem. Centr.*, 1899, ii, 624; from *Centr. Med. Wiss.*, 37, 529—530).—A specimen of hydrocele fluid was slightly opalescent, faintly alkaline, and contained traces of sodium chloride and phosphates, and 0·04 per cent. of proteid, which was mainly albumin, with a trace of globulin. Proteoses and spermin were absent. By the addition of Florence's potassium iodide solution, no crystals were formed; choline, which gives Florence's reaction as well as spermin, was therefore absent.

W. D. H.

Iodine in the Thymus and Thyroid. By LAFAYETTE B. MENDEL (*Amer. J. Physiol.*, 1900, 3, 285—290).—The accessory thyroids in man may contain relatively and absolutely more iodine than the thyroid proper of the same individual. The observations that the thyroids of newly-born children contain no iodine are confirmed. There is no satisfactory evidence to show that the carefully isolated thymus of man or animals contains iodine; traces found by others may have been due to adherent thyroidal tissue. The favourable effect of thyroid feeding in disease, like the similar effect of thymus, appears to be due not so much to the iodine as to organic substances with which it is united.

W. D. H.

Normal Existence of Arsenic in Animals and its Localisation in Certain Organs. By ARMAND GAUTIER (*Compt. rend.*, 1899, 129, 929—936).—A number of organs of different animals have been

examined for the presence of arsenic, small quantities of which were found in all the normal thyroid glands analysed; smaller proportions of this element also exist in the thymus and brain, and traces only in the skin. 127 grams of human thyroid gland gave 0.95 mg. of arsenic.

On separating the nucleins from the peptones of the thyroid gland of a sheep, all the arsenic was found in the nucleins; this points to the existence of arsenical nucleins along with those containing phosphorus.

In the following organs, arsenic could not be detected by the method of analysis employed (see this vol., ii, 168): sheep's, dog's, calf's and pig's liver, dog's and ox's spleen, pig's kidney, dog's flesh, pig's blood, and the human testicle.

T. H. P.

Fat in Glands during Inanition. By R. NIKOLAIDES (*Chem. Centr.* 1899, ii, 485; from *Arch. Anat. Physiol.*, 1899, 518—523).—Considerable importance is attached to the presence of fat in gland cells. In glands like the dog's submaxillary gland, they are present only in the albuminous acini. They arise from protoplasm by metabolic action, and disappear during inanition.

W. D. H.

The Source of Milk Fat. By WILHELM CASPARI (*Chem. Centr.*, 1899, ii, 483; from *Arch. Anat. Phys.*, 1899, Suppl., 267—280).—Even if it is shown that abundant proteid food increases the fat in milk, it does not follow that the fat originates from the proteid of the food. An important part of it is believed to originate from the fat of the food. Certainly iodised fats in the food pass into the milk, even though the food is poor in fat and rich in carbohydrates.

W. D. H.

Formation of Acetone in the Body. By WALDVOGEL (*Chem. Centr.*, 1899, ii, 396; from *Centr. inn. Med.*, 20, 729—731).—The question is undecided whether acetone comes from the proteid of the food or of the body. Administration of thyroid increases the amount of acetone, but not of uric acid, in the urine. Carbohydrates lessen the formation of acetone, if given by the mouth, but not if given subcutaneously. Fat given by the mouth increases the acetone. Rabbits and dogs excrete quite different decomposition products of fat. Acetone, acetoacetic acid, and β -hydroxybutyric acid are considered to be the result of the oxidising power of the organism.

W. D. H.

The Decomposition and Formation of Uric Acid in the Body. By HUGO WIENER (*Chem. Centr.*, 1899, ii, 262; from *Arch. exp. Path. Pharm.*, 42, 374—398).—Uric acid in the body of the rabbit leads to an increase of glycochine; this might occur by oxidation and hydrolysis with formation of allantoin and hydantoin as intermediate substances; but the experiments on animals do not confirm this. Neither can uroxamic acid or alloxan, which are highly toxic to rabbits, be regarded as intermediate substances. Extracts of the liver of dog or pig, but not of the ox, destroy uric acid; extracts of the kidney of ox and horse, but not of the dog, do so also. As uric acid can be destroyed in the body, the amount excreted in the urine in disease can be no measure of the amount produced. Glycochine is formed when uric acid is destroyed by extracts of ox kidney, but not

in so large amount as to account for all the uric acid ; the muscles of the ox give the same result. The 'surviving' ox liver is able, not only to destroy, but also to form uric acid from xanthine derivatives.

W. D. H.

Fate of Proteids after their Introduction into the Circulation. By IMMANUEL MUNK and MAX LEWANDOWSKY (*Chem. Centr.*, 1899, ii, 484 ; from *Arch. Anat. Phys.*, 1899, Suppl., 73—88).—In contradiction of Neumeister's results, it was found that if caseinogen, dissolved in soda, is introduced into the blood of rabbits (2.4 grams per kilo. of body weight), all but a small fraction is kept within the body and utilised. Egg-albumin is similarly used, in rabbits to the extent of 54 and in dogs of 82 per cent. Acid albumin, alkali-albumin, and nucleo-proteid are utilisable in a corresponding way. Proteids which have been profoundly altered, for instance, casein, are not utilised.

W. D. H.

Fate of 8-Hydroxyquinoline ; Excretion of Ethereal Hydrogen Sulphates ; Composition of Quinosol. By E. ROST (*Chem. Centr.* 1899, ii, 396 ; from *Arch. Kais. Ges. A.*, 15, 288—301).—Experiments on dogs show that 8-hydroxyquinoline leaves the body as the sulphate, and probably also as quinoline. When the amount of hydrochloric acid in the stomach is lessened, intestinal putrefaction increases, and so the amount of ethereal hydrogen sulphates in the urine rises. In complete inanition, the amount falls, but never to zero. Quinosol appears to be a mixture of 8-hydroxyquinoline sulphate and potassium sulphate.

W. D. H.

Chemical Reaction of the Intestinal Contents. By BENJAMIN MOORE and T. J. BERGIN (*Amer. J. Physiol.*, 1900, 3, 316—325).—The acid reaction of the intestinal contents to phenolphthalein is probably due to an excess of dissolved carbon dioxide. The alkaline reaction to methyl-orange, lacmoid, and litmus shows the absence of hydrochloric acid, and of all stronger organic acids, such as acetic, lactic, or butyric, which would be formed by the bacterial decomposition of carbohydrates or fats. These results were obtained by experiments on dog, sheep, and calf.

Absorption of food-stuffs, at least, in the dog, can be practically completed in the small intestine. A proteolytic enzyme active in alkaline solution, and a diastatic enzyme, also active in an alkaline solution, are present in the dog's intestine at this level.

W. D. H.

Cryoscopy of Urine in Diagnosis and Prognosis. By H. CLAUDE and V. BALTHAZARD (*Compt. rend.*, 1899, 129, 847—850).—If the difference between the freezing point of urine and that of water is corrected for the reduction due to soluble chlorides, and also, if necessary, for that due to sugar and albumin, the value δ thus obtained is a measure of the number of molecules, per unit volume of urine, of other compounds elaborated by the organism, and if this value is multiplied by the volume, V , of urine excreted in 24 hours and divided by the weight, P , in kilograms of the fixed proteids of the individual, the expression $\delta V/P$ has a value which varies greatly in different cases, and may serve as a valuable indication of

the beginning or progress of disease, especially in the case of maladies which affect the kidneys.
C. H. B.

Origin of the Proteids in Albuminuria. By MAX CLOËTTA (*Chem. Centr.*, 1899, i, 267; from *Arch. exp. Path. Pharm.*, 42, 453—466).—The proportion of serum-albumin to serum-globulin in the urine in cases of albuminuria is very different from that in the blood. This is accounted for by the different permeability of membranes to the two proteids. Nucleo-proteid, which is stated to be absent from blood-serum, is considered to arise from the kidney tissue.
W. D. H.

Sugar Formation in Severe Cases of Diabetes. By EMIL ROSENQVIST (*Chem. Centr.*, 1899, ii, 450—451; from *Berlin klin. Woch.*, 36, 612—617).—Partly on experimental, and partly on theoretical, grounds, the views of Seegen and Rumpf (*ibid.*, 36, 155), that in severe cases of diabetes mellitus fat may be a source of the sugar, is regarded as a possibility.
W. D. H.

Hydroxybutyric Acid and its Relationship to Diabetic Coma. By ADOLF MAGNUS-LEVY (*Chem. Centr.*, 1899, ii, 63—64; from *Arch. exp. Path. Pharm.*, 42, 149—237).—The amount of hydroxybutyric acid in the urine of severe cases of diabetes without coma is from 0.5 to 1 per cent. In coma, 160 grams may be excreted daily, especially if sodium hydrogen carbonate is administered. Diabetic coma is regarded as acid poisoning, but probably the production of the acid is the result of toxin poisoning. In coma, as a rule, there is no rise of proteid katabolism, although doubtless the acid originates from proteid. In urines which contain acetone, but are not diabetic, as much as 7 grams of hydroxybutyric acid may be excreted daily.
W. D. H.

Excretion and Detection of Glycuronic Acid in the Urine. By PAUL MAYER (*Chem. Centr.*, 1899, ii, 450; from *Berlin klin. Woch.*, 36, 591—593, 617—619).—The urine of a morphine-maniac contained glycuronic acid in combination, but the compound was not isolated. The greater number of tests for glycuronic acid are also given by pentoses, but if the orcinol test for pentoses is negative, and the urine contains glycuronic acid, a reducing substance will be obtained after treatment with sulphuric acid. Combinations of glycuronic acid do not yield a phenylhydrazine compound, but after treatment with sulphuric acid they do; the compounds are probably numerous, varying in melting point from 135° to 205°.

Glycuronic acid also occurs in urine after the use of chloral hydrate, and in small quantities in normal urine.
W. D. H.

Excretion of Alloxuric Substances in Nephritis. By CHARLES F. MARTIN (*Chem. Centr.*, 1899, ii, 266; from *Centr. inn. Med.*, 20, 625—631).—From observations on seven cases of different forms of nephritis, it is found that the total alloxuric substances excreted in the day are diminished, but the relation of the alloxuric bases to uric acid is but little altered.
W. D. H.

Theory of Narcosis. I. By HANS MEYER (*Chem. Centr.*, 1899, ii, 64; from *Arch. exp. Path. Pharm.*, 42, 109—118). **II.** By FRITZ BAUM (*Chem. Centr.*, 1899, ii, 65, from *ibid.*, 119—137).—In reference to Dubois' work on the action of anæsthetics (*Compt. rend. Soc. Biol.*, 1884, 583), the theory is advanced that the relative strength of these substances is dependent on their mechanical affinity for fatty substances (like lecithin in protoplasm), on the one hand, and to other constituents of protoplasm, especially water, on the other. In support of this view, the second paper shows that the proportion between concentration in fat and concentration in water of a number of narcotics runs parallel with their anæsthetising activity.

W. D. H.

Physiological Action of Creatine and Creatinine and their Value in Nutrition. By JOHN W. MALLETT (*Chem. Centr.*, 1899, ii, 563; from *Bull. No. 66, U.S. Dept. Agric.*; and *Chem. News*, 80, 43—45, 54—56, 69—71, 77—78).—Almost the whole of the creatine and of the creatinine given to human beings is excreted as creatinine in the urine; the fæces contain none. These bases do not therefore serve for the building up of proteids. They are not, however, intermediate substances between proteid and urea, and it is not probable that these bases in muscle are changed even slowly into urea. This supports the view so often urged by physiologists that meat extracts have no nutritive value. The physiological action of creatine and creatinine is much weaker than commonly supposed.

W. D. H.

Rôle of Leucocytes in Poisoning by Compounds of Arsenic. By BESREDKA (*Ann. de l'Inst. Pasteur*, 1899, 13, 49—66, 209—224, 465—479).—The leucocytes are capable of engulfing toxic substances, among them various compounds of arsenic, arsenic trisulphide and arsenious acid being specially investigated. Leucocytosis is one result of the injection, but the healthy state, as well as the number of the leucocytes, is important. After traversing the leucocytes, the metal is ultimately eliminated by the urine. If positive chemiotaxis and leucocytosis do not occur, the animal dies; if they do, it is protected. The administration of previous small doses renders the animal immune to fatal doses. The *antiarsenin* present in the serum is probably not a compound of arsenic. The intermediate rôle of the leucocytic action is, however, essential in the antagonism.

W. D. H.

Action of the Tetanus Toxin on Nervous Substance. By JEAN DANYSE (*Ann. de l'Inst. Pasteur*, 1899, 13, 156—168).—The nervous tissues fix to some extent the tetanus toxin, but this is not permanent, for *in vitro*, and probably *in vivo*, the toxin is again liberated by suitable media like physiological saline solution. The insoluble materials of the nervous tissue possess this power to the greatest degree, and the toxin is thus in part neutralised, but a determination of how much is rendered impossible by the fact that the soluble constituents of the tissue increase the toxic action.

W. D. H.

Fungus Poisons which Decompose Blood. By RUDOLF KOBERT (*Chem. Centr.*, 1899, ii, 781; from *Sitzungsber. naturf. Ges. Rostock*, 1899, No. 5).—*Agaricus phalloides* contains at least two poisons, con-

sisting of an alkaloid and a toxalbumin. When the alkaloid, which is soluble in alcohol but insoluble in ether, is administered to rabbits or cats, neither decomposition of the blood nor fatty degeneration of the organs takes place. The toxalbumin *phallin* has a stronger action than helvellic acid, but resembles it in dissolving the red corpuscles of the blood, dissolved oxyhæmoglobin, glycerophosphoric acid, and fragments of stroma also taking part in the action. By the liberation of glycerophosphoric acid, the alkalescence of the blood is decreased, the soluble hæmoglobin partially converted into methæmoglobin, and cyanose formed. A solution of phallin in 100,000 parts of water is sufficient to show the dissolving action on the red blood-corpuscles. Sections obtained from animals which had been poisoned by phallin showed many exudations of blood into the various organs. In many cases, the blood and urine were found to contain methæmoglobin or bile-colouring matters, and in most cases the kidneys were greatly affected. Phallin could not be detected in mushrooms or other edible fungi.

E. W. W.

Chemistry of Vegetable Physiology and Agriculture.

Buchner's Yeast Extract. By AUGUSTIN WRÓBLEWSKI (*Chem. Centr.*, 1899, ii, 672—673; from *Centr. Physiol.*, 13, 284—297. Compare Abstr., 1899, ii, 170).—The extract from a pure culture of wine yeast resembles that of ordinary yeast, both in composition and properties and, like it, is capable of fermenting sugar. The fermenting power of the zymase of the extract obtained from a pure culture of beer yeast is destroyed by the presence of formalin; 0.07 per cent. of hydroxylamine hydrochloride also exerts a slight preventive action, and larger quantities completely inhibit fermentation. From the results of experiments with pure hydrochloric acid, it is evident that the hydroxylamine hydrochloride combines with certain constituents of the extract, liberating hydrochloric acid, which then attacks the zymase. The extract has a denitrifying action on sugar solutions containing nitrites, and liberates nitrogen, but not carbon dioxide. Since the yeast cells are killed by even small quantities of nitrites, denitrification cannot be attributed to their action. The reduction of nitrites in soil is a purely chemical process, depending on their action on compounds analogous to amino-compounds, the action of small organisms being only of secondary importance. Nitrates are neither affected by the yeast nor its extract, and, like sodium chloride and ammonium sulphate, only hinder fermentation when present in large quantities. The addition of small quantities of neutral salts appears to increase the fermenting action of the yeast or of its extract, but large quantities of alcohol hinder fermentation, probably by precipitating the proteids of the extract.

The invertin resembles the proteose and peptone-like constituents of the extract, for when the extract is saturated with ammonium sulphate only a portion of the invertin is carried down mechanically, the major portion remaining in the filtrate. Invertin may be purified by fractionally precipitating with acetic acid, and finally fractionally precipitating from the acetic acid solution by means of alcohol. The inverting action of the invertin is increased by dilute acetic acid, and even a 4 per cent. solution of the acid does not very seriously interfere with this action. A 0.28 per cent. solution of hydrochloric acid does not appreciably affect the inverting power of invertin, but the prolonged action of alcohol, or the presence of even dilute solutions of alkalis, destroys it.

The properties of the zymase do not resemble those of the enzymes contained in the extract, and the former substance is more allied to protoplasm than to the group of proteoses and peptones. Zymase, unlike the enzymes, is unable to pass through an earthenware cell, and ferments only in concentrated solutions, dilution of the extract causing a rapid decrease of fermentation. Fermentation is also promoted by the addition of 1.5 per cent. of neutral salts. The enzymes, on the other hand, work better in dilute solutions and without the addition of salts. The effect of dilution and of the addition of neutral salts on the fermenting action of zymase appears to depend on osmotic processes.

E. W. W.

[A Beer Disease.] By VAN LAER (*Compt. rend.*, 1900, 130, 53—56).—Beers termed by Belgian brewers "double face" or "*twesekinds*" are quite clear by transmitted light, but by reflected light are dull brown and opalescent. Viewed from above, they appear dirty white and opaque, with a yellow fluorescence. This malady is closely connected with viscous fermentation, and seems due to a special organism, *Bacillus viscosus bruxellensis*, which always makes beer works ropy; its development is promoted by the presence of nitrogenous compounds, but its effects are reduced if the liquid is thoroughly aerated. The bacillus converts carbohydrates into lactic, acetic, and butyric acids, either by consuming them directly, or by first converting them into gummy substances. Other conditions being equal, dextrose is first attacked and then saccharose, maltose, and lactose. No invert sugar is formed.

C. H. B.

Reactions to Stimuli in Unicellular Organisms. By HERBERT S. JENNINGS (*Amer. J. Physiol.*, 1900, 3, 229—260. Compare Abstr., 1899, ii, 440).—This is a continuation of previous work in which *Paramecium* was used. It has been extended to *Chilomonas* and other flagellates, and also to numerous ciliated infusorians. The main results confirm those previously reached. Some of the results are now rather differently interpreted in accordance with modern chemical doctrines of solutions.

W. D. H.

Effect of Ions on Flagellated Infusoria. By WALTER E. GARREY (*Amer. J. Physiol.*, 1900, 3, 291—315).—*Chilomonas* was the organism selected as the subject of the experiment. The effect of

chemicals is analogous to those of other stimuli like light or galvanism. Whilst inorganic acids have equal effects if the ion concentration is the same, organic acids behave differently and the effect is greater than would be expected.

W. D. H.

Bacteriological Enzymes as a Cause of Immunity and their Healing Action in Infective Diseases. By RUDOLF EMMERICH and OSKAR LÖW (*Chem. Centr.*, 1899, ii, 135; from *Zeit. Hyg.*, 31, 1—65).—The enzymes secreted by various bacteria unite with the proteids of blood or of organs; the compounds so formed are termed *immunoproteidins*; the proteid of the leucocytes which unites with the enzyme of the pathogenic bacteria is termed *proteid*. The so-called agglutination is nothing but the first stage of the effect of the enzyme. There are also bacterial enzymes which are not only bactericidal, but also destroy toxins; thus *pyocyanase*, the enzyme of *Bacillus pyocyaneus*, destroys the deadly effect of the diphtheria toxin.

W. D. H.

Changes in the Mineral Constituents of the Seed during Germination. By GUSTAVE ANDRÉ (*Compt. rend.*, 1899, 129, 1262—1265).—A preliminary communication dealing with observations made on the variation of the mineral constituents of the Spanish bean (*Phaseolus multiflorus*) from the commencement of germination to the period at which the dry weight of the seedling is again equal to that of the seed. The weight of mineral substances is trebled, but the constituents do not vary to the same extent. The quantity of phosphoric acid remains fairly constant, and there is a slight increase in the total nitrogen.

As long as the plant feeds on its reserve materials, the amount of potash remains constant, but when the chlorophyllous functions develop, the weight of this constituent increases. The amounts of silica and lime present at the end of the period under observation are respectively 400 times and 17 times as great as the original quantities. The analytical results are arranged in tabular form.

G. T. M.

Chlorophyllous Assimilation induced by Sunlight filtered through Leaves. By ED. GRIFFON (*Compt. rend.*, 1899, 129, 1276—1278).—Timiriazeff found that whitelight, after passing through a chlorophyll solution, loses its power of inducing chlorophyllous assimilation.

The author finds that sunlight, after traversing a single leaf still induces the decomposition of carbon dioxide, but the action is considerably diminished, and with diffused light is almost negligible. The effect produced by sunlight after passing through two leaves is so feeble that the assimilative action is masked by respiration.

These results are chiefly due to the absorption of luminous radiations by chlorophyll, but protoplasm and the colourless parts of leaves also diminish the action; the effect of light filtered through bleached or chlorotic leaves is approximately half that due to direct sunlight.

G. T. M.

Amount of Sulphur in Plants. By SERGEI M. BOGDANOFF (*Chem. Centr.*, 1899, ii, 489; from *J. Russ. Phys. Chem. Soc.*, 31, 471—477).—Estimation of sulphuric acid in vegetable ashes gives incorrect results, as considerable loss of sulphur may take place during incineration. Liebig's method is very satisfactory, and when small amounts of potassium nitrate are employed the results are very exact.

Plants contain much more sulphur than is indicated in Wolff's tables, and it is believed that the amount of sulphuric acid in soil is of practical importance. In some Russian soils, certain crops gave considerably higher yields after manuring with sulphates.

N. H. J. M.

Hydrocyanic Acid in Vicia Seeds. By F. F. BRUYNING, jun., and J. VAN HAARST (*Rec. Trav. Chim.*, 1899, 18, 468—471).—Flour from the following species and varieties of *Vicia* contains hydrocyanic acid: *V. sativa*, *V. sativa* v. *dura*, *V. sativa* v. *flore alb.*, *V. sativa* v. *Bernayer*, *V. sativa* v. *Britannica*, *V. canadensis*, *V. hirsuta*, and *V. angustifolia*; these hence contain amygdalin or analogous substances. No hydrocyanic acid was detected in: *V. narbonensis*, *V. cracca*, *V. agrigentina*, *V. biennis*, *V. disperma*, *V. pannonica*, and *V. casubica*.

500 grams of flour from *V. sativa* contained 0.004 gram of hydrocyanic acid, and after germination for three days, the quantity was 0.003 gram. In the case of *V. sativa Britannica* and *V. angustifolia*, the same weight of flour yielded 0.0008 and 0.027 gram of acid respectively.

T. H. P.

Presence of Mannocellulose in the Ligneous Tissues of Gymnosperms. By GABRIEL BERTRAND (*Compt. rend.*, 1899, 129, 1025—1028. Compare Abstr., 1879, 613).—The tissues of the gymnosperms contain practically no xylan, but mannocellulose is present in considerable amount. The yield of mannose (obtained from mannocellulose by hydrolysis) from conifers is from 10—15 per cent. of the wood taken. In the *Gnetaceæ*, a class intermediate between the gymnosperms and angiosperms, the amount of mannocellulose is very small, and in some cases *nil*.

H. R. LE S.

Presence of Formaldehyde in Plants. By GINO POLLACCI (*Chem. Centr.*, 1899, ii, 881—882; from *Boll. Chim. Farm.*, 38, 601—603).—When leaves which have been exposed to the light are macerated and distilled with water, the first portion of the distillate contains formaldehyde. This compound was detected by the violet coloration produced on adding a mixture of codeine and sulphuric acid. This mixture is extremely sensitive to formaldehyde and even more so to the polymeric formaldehyde which is formed when the aqueous solution is evaporated. Other aldehydes such as acetaldehyde, propaldehyde, butaldehyde, valeraldehyde, and benzaldehyde give a yellow, whilst vanillin and acetone form a green, coloration. The formation of a solid, white polymeride, by slowly evaporating the aqueous solution at the ordinary temperature, is also characteristic of formaldehyde. The presence of this aldehyde was also detected by

the following methods. (1) An aqueous solution of aniline gives a white precipitate with formaldehyde. (2) When the distillate containing formaldehyde is added to a dilute solution of benzophenol and a solution of 94 per cent. sulphuric acid then poured into the mixture, a red ring is formed at the surface of contact of the liquids. (3) When a twig with green leaves which has been exposed to light is placed in an aqueous carmine solution which has been decolorised by sulphurous acid, the leaves become violet after a time, whilst the solution itself remains colourless. Magenta decolorised by sulphurous acid gives a violet coloration with formaldehyde. (4) Ammoniacal silver nitrate solution is reduced. (5) Nessler's reagent test-paper is turned black; and (6) phenylmethylhydrazine gives a white precipitate with the distillate.

E. W. W.

The "Honey" of *Euonymus Japonica*. By LÉON MAQUENNE (*Bull. Soc. Chim.*, 1899, [iii], 21, 1082—1083).—The honey-like substance which is sometimes found in dry seasons at the extremities of the branches of *Euonymus Japonica* is an exudation of the cell contents due to the punctures of insects; it is at first of a syrupy consistence, but soon dries to a crystalline mass. It has a marked sweet taste and is very soluble in water. When concentrated by evaporation, the solution deposits crystals of dulcitol and leaves a brownish, syrupy residue in which dextrose and saccharic acid were detected.

N. L.

Lotus Corniculatus. By GIUSEPPE D'ANCONA (*Chem. Centr.*, 1899, ii, 590—591; from *Staz. sper. agrar. ital.*, 32, 274—287).—Analyses of two Italian specimens of *Lotus corniculatus* are given:

Water.	Crude proteid.	Crude fat.	Crude fibre.	N-free extract.	Digestible nitrogen.	Ash.
1. 80.285	3.429	0.723	6.563	7.582	0.256	1.418
2. 76.489	3.730	0.872	8.113	8.859	0.312	1.937

The dry substance contained (1) 10.757 and (2) 11.233 per cent. of pentosans. The pure ash had the following percentage composition:

K ₂ O.	Na ₂ O.	CaO.	MgO.	Fe ₂ O ₃ + Al ₂ O ₃ .	P ₂ O ₅ .	SO ₂ .	SiO ₂ .	Cl.
1. 21.954	7.405	24.969	5.082	3.637	10.026	4.915	20.781	0.884
2. 21.987	6.772	23.629	4.091	5.066	10.687	4.383	22.335	1.029

N. H. J. M.

Absorption of Soluble Salts by Plants. By EM. DEMOUSSY (*Ann. agron.*, 1899, 25, 497—548 and 561—607).—A detailed account of experiments already described (*Abstr.*, 1899, ii, 172 and 238), with an historical introduction.

With regard to nitrates, the nature of the base has no effect on absorption by plants when supplied singly, provided that the base is not toxic; lithium, barium, and strontium nitrates, for instance, are only taken up in very small quantities, and their injurious effect soon becomes evident.

The fact that although plants absorb non-toxic metals with equal readiness, the amounts of these metals found in plants vary very greatly is attributed partly to the composition of the media in which the plant lives, and partly to the selective powers of plants.

Calcium, unlike potassium, does not prevent absorption of sodium.

Plants growing in solutions containing the same amount of calcium as nitrate and as chloride respectively absorbed more calcium in the form of nitrate than as chloride, but the absorption of chlorine was greater than that of nitrogen, owing to its greater molecular weight ; 2 mols. of nitrogen were absorbed to 1 mol. of chlorine.

N. H. J. M.

Composition of the Branches of Pear Trees Removed by Regular Thinning. By NAPOLEONE PASSERINI (*Bied. Centr.*, 1899, 28, 780—781; from *Ricerche e. Esper. Istituto Agrar. Scandicci*, 1896—1897).—Branches (without leaves) cut from pear trees were found to have the following composition :

Water.	N.	CO ₂ in		Per cent. in pure ash.							
		Crude ash.	Digestible crude ash.	K ₂ O.	CaO.	MgO.	Fe ₂ O ₃ .	P ₂ O ₅ .	SO ₃ .	Na ₂ O, Cl.	SiO ₂ loss.
49.29	0.506	1.748	33.79	15.11	63.00	4.51	0.60	4.90	2.64	1.66	7.58

In the case of old pear trees, it was found (average of twelve experiments) that 1381 kilograms of wood are cut yearly. The loss per annum is therefore as follows : N, 6.99 ; K₂O, 2.40 ; CaO, 10.02 ; MgO, 0.72 ; P₂O₅, 0.78, and SO₃, 0.42 grams in each tree. The soil for pear trees should be comparatively rich in lime, and requires nitrogenous and potash manures.

N. H. J. M.

Which Meadows should be Manured with Potash as well as with Basic Slag and Superphosphate? By JULIUS NESSLER (*Bied. Centr.*, 1899, 28, 737—738; from *Woch. Landw. Ver. Baden*, 1899, No. 11, 139).—Level meadows, the soil of which is poor in potash but not too shallow, with much moss, &c., should receive, in autumn or winter, kainite (6—8) and basic slag (3—4 cwt.), and each subsequent year 2—3 and 3—4 cwt. respectively of basic slag and kainite. In the case of heavy soils, superphosphate is usually preferred to basic slag, and potassium chloride (40 per cent.) is employed instead of kainite.

Sloping meadows should have more potash applied to the higher than to the lower portions, which in some cases do not require direct potash manuring. Irrigation with water from granite or gneiss generally renders application of potash unnecessary.

The best chemical method of ascertaining whether potash is needed is to determine the amount of potash in the hay ; the grass must be cut at the beginning of the flowering period and carefully dried. Estimating the potash in the soil takes longer and gives more uncertain results.

N. H. J. M.

Composition of *Molinia caerulea* and *Carex Goodenoughii*. By HEINRICH IMMENDORFF (*Bied. Centr.*, 1899, 28, 772—774; from *Landw. Jahrb.*, 1898, 27, iv, 503).—The two plants are important constituents of the herbage of peat meadows which are insufficiently drained and manured, but are not much valued as cattle-food. The composition as hay (water = 15 per cent.) is as follows :

	Crude protein.	Digestible protein.	Amides.	Fat.	N-free extract.	Crude fibre.	Ash.
1. <i>Molinia caerulea</i>	6.75	4.26	0.88	2.44	41.28	30.96	3.47
2. <i>Carex Goodenoughii</i>	9.00	4.69	0.60	2.51	42.14	27.40	3.94

Whilst *Molinia* hay is of very poor quality, the results obtained with *Carex* are more satisfactory, but the yield is very small. The dry substance of the two plants contained: Ash, (1) 4.196, (2) 4.64; K_2O , (1) 1.21, (2) 1.49; CaO , (1) 0.25, (2) 0.39; and P_2O_5 , (1) 0.29, (2) 0.43 per cent. N. H. J. M.

Hops and Hop Soils. By JOSEPH HANAMANN and LEOPOLD KOURINSKY (*Bied. Centr.*, 1899, 28, 778; from *Zeit. Landw. Versuchs-wesen. Oesterr.*, 1898, 1, 411).—During the early periods of growth, hop plants require plenty of potash, phosphoric acid, and nitrogen; subsequently, the plants contain nearly as much lime as potash.

The leaves and tendrils are rich in lime, and in the assimilating organs 50 per cent. of the ash consists of lime, indicating considerable production of organic acids in the sap, which have to be neutralised with lime. The leaves contain much more potash, lime, magnesia, and phosphoric acid than the tendrils and stems, whilst the umbels contain the most potash and phosphoric acid.

In the original paper, analyses of the soil and of the ashes of hops at different periods of growth are given. N. H. J. M.

Influence of Potash on the Development of Sugar Beet. By JULIUS STOKLASA (*Chem. Centr.*, 1899, ii, 490; from *Zeit. Zucker-Ind. Böhm.*, 23, 493—501).—Results of field experiments showed that potassium sulphate considerably increased the yield of roots and the percentage of sugar. Potassium chloride, in conjunction with superphosphate and nitrate, also increased the yield of roots without injuriously affecting the percentage of sugar. N. H. J. M.

Assimilation by Sugar Beet and Estimation of Available Nutritive Matter in Arable Soil. By H. WILFARTH (*Chem. Centr.*, 1899, ii, 536—537; from *Zeit. Ver. Rübensucker-Ind.*, 1899, 645—652).—Whilst sugar beet grows normally when manured with nitrate, ammonium salts and blood-meal gave decidedly unsatisfactory results.

Amides were determined in the roots as an indication of the degree of unripeness.

When calcium nitrate is employed as manure, the lime is eliminated from the root, whilst with potassium nitrate the potash is retained. Deficiency of nitrogen gives rise to yellow leaves, whilst a deficiency of potash produces brown and white spots on the leaves. In absence of sufficient phosphoric acid, the leaves do not become yellow as stated by Stoklasa, but their growth is checked, and they have a dark green colour with black edges and spots.

The results of pot experiments showed that with insufficient potash the roots contained only 4 parts of K_2O to 1000 parts of sugar, the amounts under normal conditions being 6—8 parts; with six times the necessary amount of potash, the roots were found to contain 37 parts of K_2O per 1000 of sugar. The roots are more liable to injury by nematodes in absence of potash than when a small amount of potash is applied.

It is proposed to estimate available plant constituents in soils by growing sugar beet, carrots or celery, and analysing the plants.

N. H. J. M.

Influence of the Amounts of Water and of Nutritive Substances in Soil on the Activity and Development of Potatoes. By JOHANN WILMS (*Chem. Centr.*, 1899, ii, 628; from *J. Landw.*, 47, 251—292).—The occasional injurious effect of Stassfurt salts on potatoes is attributed to the presence of potassium chloride. Nitrogenous substances are favourable to the development of the plants and to starch production. Potash also seems favourable to starch production. Increased amounts of moisture in the soil always diminish the percentage of starch in the tubers; and proportions of chlorides, which are otherwise harmless, become injurious when the amount of water is large. Transpiration is increased when the percentage of water in the soil increases, and there may be an increase, although less marked, in the actual amount of starch produced.

N. H. J. M.

How much Phosphoric Acid should good Arable Soil Contain? By AIMÉ PAGNOUL (*Ann. Agron.*, 1899, 25, 549—557).—The results of pot experiments, in which incarnate clover was grown in soils containing very little, and a good deal, of phosphoric acid respectively, with and without addition of superphosphate, indicated that 0.1 per cent., which is generally considered to be a normal amount for good soil, is too low, and that 0.15 to 0.2 per cent. is more probably the limit, at any rate for incarnate clover, beyond which manuring with phosphates becomes unnecessary.

N. H. J. M.

Alinit. By W. KRÜGER and W. SCHNEIDEWIND (*Chem. Centr.*, 1899, ii, 628; from *Landw. Jahrb.*, 28, 579—591).—Experiments were made on the behaviour of alinit towards free atmospheric nitrogen in nutritive solutions containing nitrogenous matters, and also towards nitrates. It is concluded that the preparation is without practical value. The microbe does not nitrify, but there was production of nitrite.

N. H. J. M.

Composition of Green Manure grown on Peaty and on Sandy Soils. By HEINRICH IMMENDORFF (*Bied. Centr.*, 1899, 28, 726—733; from *Landw. Jahrb.*, 1898, 27, 503).—The composition as regards dry matter and nitrogen of the crops grown for green manure on peat land (yellow, blue, and white lupins, serradella, grey peas, beans, rape, and white mustard) scarcely differs from that of the same plants grown in ordinary soil. In absence, however, of inoculation, the percentage of nitrogen in the dry matter is liable to be very low. In the case of blue lupins, for instance, the nitrogen in the dry matter was (1, inoculated) 3.26 and (2, not inoculated) 1.98 per cent.

In light, sandy soils, the most suitable crops for green manuring are lupins and serradella (white mustard is quite unsuitable), and the composition of the plants is normal. Application of burnt lime (3,000 kilograms per hectare) was very beneficial, even in the case of lupins. The soil did not require inoculation.

Pot and field experiments were made to ascertain the amounts of organic matter and nitrogen in the above-ground growth and roots of serradella and lupins grown in peaty soil fully manured with minerals. Normal percentages of nitrogen, both in roots and in the growth

above-ground, were only obtained after inoculation. Lupins yield (in the roots) more organic matter than serradella, but the latter is more nitrogenous.

Crops of serradella and lupins the above-ground growth of which contain 100 and 140 kilograms of nitrogen per hectare, yield in the roots about 15 and 20 kilograms of nitrogen respectively; these amounts may undoubtedly be increased by deepening the soil.

N. H. J. M.

Testing Soils for Application of Commercial Fertilisers. By H. A. WEBER (*J. Amer. Chem. Soc.*, 1899, 21, 1095—1099).—Five carefully selected portions of the soil are put into Wagner pots, and to four of these are added various descriptions of manure to ascertain which will answer best.

The seeds of the crops required to be raised are then introduced with the usual precautions and allowed to germinate; it is not necessary to bring the plants to maturity; observations made during 5 or 6 weeks will give sufficient information.

L. DE K.

Analytical Chemistry.

Estimation of Chlorine in Bleaching Powder. By C. WOŁOWSKI (*Zeit. anal. Chem.*, 1899, 38, 711—713).—The hypochlorite solution is added from a burette to potassium iodide acidified with sulphuric acid. A number of mixtures are made in which the amount of iodide is the same, and by shaking each mixture with chloroform the point is ascertained at which enough chlorine has been added to convert all the iodine into trichloride, which of course does not colour the chloroform. The author prefers to work with only 5 milligrams of potassium iodide, and measures the hypochlorite solution by counting the drops.

M. J. S.

Separation of Chlorine and Iodine. By LUDWIG VANINO and O. HAUSER (*Ber.*, 1899, 32, 3615—3617. Compare Abstr., 1898, ii, 545; and 1899, ii, 249).—Silver iodide, when heated at 90° with formaldehyde dissolved in 50 per cent. potassium hydroxide solution, is scarcely affected, whereas silver bromide under these conditions is almost wholly reduced, a considerable amount of reduction taking place even at the ordinary temperature; silver chloride is completely decomposed, even in the cold. When a mixture of silver chloride and iodide is heated at 40° with an alkaline formaldehyde solution of the above strength, the chloride is completely reduced, whilst the iodide remains unchanged; the precipitate is treated with nitric acid, the silver derived from the chloride dissolves, and is reconverted into the haloid salt. In this way, a quantitative separation of iodine and chlorine may be rapidly effected.

G. T. M.

Titration of Potassium Iodide. By E. VINCENT (*J. Pharm.*, 1899, [vi], 10, 481—483).—The valuation of potassium iodide may be rapidly and accurately effected by the following process, which avoids the errors incidental to some of the methods usually employed. A suitable quantity of the solution obtained by dissolving 1 gram of the sample in a litre of water is mixed with an equal volume of a 0.2 per cent. solution of iodic acid, and the liquid added from a burette to 5 or 10 c.c. of *N*/10 thiosulphate solution until a permanent yellow tint is produced. 0.2 per cent. of potassium hydrogen carbonate is added to the thiosulphate solution in order to prevent oxidation of the latter by the excess of iodic acid. N. L.

Estimation of [Dissolved] Oxygen in Water. By F. ZETSCHE (*Chem. Centr.*, 1899, ii, 727; from *Zeit. Unters. Nahr-Genussm.*, 2, 696—697).—A glass-stoppered bottle of 250—300 c.c. capacity is filled completely with the water; 1 c.c. of a saturated solution of manganous sulphate is introduced at the bottom of the liquid by means of a pipette, followed by 2 c.c. of a solution containing 48 grams of sodium hydroxide and 15 grams of potassium iodide per 100 c.c. The whole is now thoroughly shaken, and when the manganous-manganic hydroxide has subsided, the stopper is removed, 5 c.c. of hydrochloric acid are introduced, the stopper is replaced, and the whole shaken until a clear solution is obtained. The liquid is then emptied into a beaker, and the liberated iodine titrated with *N*/100 solution of sodium thiosulphate. When calculating the result, 3 c.c. only must be deducted for the reagents added; the volume of the hydrochloric acid added does not affect the calculations. L. DE K.

Estimation of Sulphuric Acid in the Presence of Iron. By GRÉGOIRE N. WYROUBOFF (*Bull. Soc. Chim.*, 1899, [iii], 21, 1046—1049. Compare Abstr., 1899, ii, 329 and 611).—A criticism of the methods described by Küster and Thiel (Abstr., 1899, ii, 247). N. L.

Estimation of Nitrogen in Fertilisers containing Nitrates. By F. P. VEITCH (*J. Amer. Chem. Soc.*, 1899, ii, 1094—1095).—Fields' process is recommended with only a slight modification. To the nitrate, 35—40 c.c. of sulphuric acid containing 34 grams of salicylic acid per litre, and after it has dissolved, 6—7 grams of crushed potassium sulphide, are added. After first heating over a low flame for 15 minutes, the contents are boiled for $1\frac{1}{2}$ hours, then cooled and distilled as usual with excess of soda. L. DE K.

Direct Estimation of Available Phosphoric Acid. By F. P. VEITCH (*J. Amer. Chem. Soc.*, 1899, 21, 1090—1094).—The sample is first extracted with water and the solution filtered into a 500 c.c. measure containing 5—10 c.c. of nitric acid. The insoluble residue is then treated with the ordinary ammonium citrate solution and the two liquids are united. The phosphoric acid is now precipitated in an aliquot part of the solution by means of the ordinary molybdate solution, the precipitation being probably complete in two hours at 65°. It does not seem necessary to destroy the citric acid, or any other organic matter present in the manure. L. DE K.

[**Estimation of the Available Phosphoric Acid in Soil.**] By AIMÉ PAGNOUL (*Ann. Agron.*, 1899, 25, 554—557).—After determining the dry matter and calcium carbonate, an amount of soil containing 10 grams of dry matter is digested for 2 hours with a solution containing 120 grams of glacial acetic acid in 1 litre (10 c.c. *plus* the amount required to dissolve the calcium carbonate) diluted with water to 50 c.c., the whole being shaken twelve times during digestion. The phosphoric acid is then determined in 25 c.c. of the filtered extract, by means of the colour reaction produced by potassium ferrocyanide in very dilute phosphomolybdate solution. The solutions required are (1) ordinary ammonia, 100 c.c., diluted to 1 litre; (2) sulphuric acid, 70 or 80 c.c., diluted to 1 litre; (3) potassium ferrocyanide, 10 per cent.; and (4) a standard phosphomolybdate solution containing exactly 4 milligrams of phosphoric acid per litre. This is prepared by precipitating a solution of sodium or ammonium phosphate, containing 4 mg. of phosphoric acid, as phosphomolybdate in the usual manner, decanting over a small filter, and washing with nitric acid until the filtrate gives no coloration with ferrocyanide. The whole is then dissolved in the dilute ammonia (solution 1) and made up to 1 litre with the same dilute ammonia.

The phosphoric acid in 25 c.c. of extract (corresponding with 5 grams of soil) is determined by precipitating as phosphomolybdate, filtering, and redissolving the precipitate in the dilute ammonia. The volume of the solution (V) will be from 10—50 c.c., according to the amount of precipitate. 5 c.c. of the standard phosphomolybdate solution (containing $P_2O_5 = 0.02$ milligram) is next put into a tube 2 cm. wide and divided into c.c., 5 c.c. of the solution to be examined being put into a similar tube. After adding ferrocyanide solution (2 c.c.) to both tubes, dilute sulphuric acid (solution 2) is added drop by drop until a permanent brown tint is obtained. A few drops of water are added to the tube containing the standard solution to make the volume up to 10 c.c., whilst the liquid in the second tube is diluted until the tints of both are alike, and the volume (V') read off. The phosphoric acid, in mg. per cent., in the soil will be $0.4 \times \frac{V_1}{10} \times \frac{V}{5}$. If the colour

produced by 5 c.c. of solution is too dark, 1 or 2 c.c. may be employed, but the solution must then be diluted with the ammonia solution to 5 c.c. before adding the ferrocyanide. A number of determinations may be made simultaneously with advantage. N. H. J. M.

Detection of Fraudulent Additions to Bone Superphosphate. By HENRI LASNE (*Chem. Centr.*, 1899, ii, 973—974; from *Ann. chim. anal. app.*, 4, 235—331).—A microscopical examination will indicate the origin of added mineral phosphates, foreign minerals, &c.

To facilitate the microscopic research, the sample may be first freed from true bone phosphate by successive treatment with dilute (3 per cent.) acetic acid and a concentrated solution of ammonium citrate.

L. DE K.

Valuation of Basic Slags. By FRANZ W. DAFERT (*Chem. Centr.*, 1899, ii, 727; from *Zeit. Landw. Vers.-Wes. Oesterr.*, 2, 467—476).—The author states that the valuation of basic slags by their citrate

solubility cannot be considered a scientific method, as it depends too much on the personal equation of the operator. L. DE K.

Detection and Estimation of very small Quantities of Arsenic in the Organs. By ARMAND GAUTIER (*Compt. rend.*, 1899, 129, 936—938).—The method, details of which are given, consists essentially in destroying the organic matter by successive treatment with nitric acid, sulphuric acid, and, finally, nitric acid again; the arsenic is precipitated, together with an excess of sulphur, by hydrogen sulphide, the precipitate digested with ammonia to dissolve the arsenious sulphide, which is then oxidised by a mixture of nitric and sulphuric acids, and finally treated by Marsh's method for detecting arsenic. T. H. P

Estimation of Graphitic Carbon in Cast Iron and Pig Iron. By ALLEN P. FORD and IVAN M. BREGOWSKY (*J. Amer. Chem. Soc.*, 1899, 21, 1113—1115).—1 gram of the sample is dissolved in nitric acid of sp. gr. 1.2; a few drops of hydrofluoric acid are then added and the liquid boiled for a short time to dissolve the silicon. After diluting with four times the bulk of water, the insoluble matter is collected on a Gooch's crucible, the asbestos of which has been selected with care and purified by digestion in hydrochloric acid. After drying for fully an hour at 120°, the crucible is weighed, the graphite burnt off, and the crucible re-weighed, the difference representing the graphite. L. DE K.

Report of the [American] Committee on Coal Analysis. By WILLIAM A. NOYES, WILLIAM F. HILLEBRAND and CHARLES B. DUDLEY (*J. Amer. Chem. Soc.*, 1899, 21, 1116—1132. Compare Abstr., 1898, ii, 488).—Final instructions are given as to the analysis of coal so as to ensure uniform results. When estimating the sulphur, it is recommended to avoid the use of coal gas. If an ultimate analysis is thought desirable, the sample should be burnt with lead chromate so as to retain the sulphur; it is unnecessary to employ a spiral of copper. When calculating the percentage of oxygen, it is recommended to deduct from 100 the sum of the carbon, hydrogen, nitrogen, ash, and five-eighths of the sulphur. In the preliminary report, it was recommended to give the heating effect on the basis of the coal burned to "vapour of water at 100°;" this is now altered to "liquid water at the ordinary temperature." L. DE K.

Estimation of Volatile Combustible Matter in Coke and Anthracite Coal. By RICHARD K. MEADE and JAMES C. ATTIX (*J. Amer. Chem. Soc.*, 1899, 21, 1137—1145).—In order to completely expel the last portions of volatile matter from coke or anthracite, it is necessary to finally employ the blast, but this causes some of the carbon to burn; the oxidation may be practically prevented by heating in a current of nitrogen.

If after heating a sample over a blast, say, for 7 minutes and weighing, the ignition is continued for another 7 minutes under exactly the same conditions, the second loss in weight should

represent with fair accuracy the amount of carbon oxidised during the first heating. The results obtained by this correction are satisfactory.

L. DE K.

Apparatus for the Analysis of Illuminating and Fuel Gases. By GEORGE E. THOMAS (*J. Amer. Chem. Soc.*, 1899, 21, 1108—1112).—This is a compact apparatus for technical work. It consists essentially of a burette and levelling tube joined by rubber and capillary glass tubes to a series of absorbing bottles, filled with aqueous caustic potash, bromine water, and phosphorus covered with water, another bottle is filled with water only, as it is only used for storing gas.

There is also the usual arrangement for exploding mixtures of gas and air. The water in the burette is acidified with sulphuric acid so as to diminish the solubility of carbon dioxide.

L. DE K.

Chemical Detection of Carbonic Oxide in Blood. By KARL IPSEN (*Chem. Centr.*, 1899, ii, 889; from *Vierteljahrschr. gericht. Med. öffentl. Sanitätswes.*, [iii], 18, 46—65).—4—10 c.c. of the suspected blood is put into a small test-tube, a drop of caustic alkali is added, and then a small amount of dextrose. After closing the tube with cotton wool and sealing it with paraffin wax, it is well shaken and kept for some length of time in a cool place. A blank experiment should be made with pure blood at the same time.

Blood containing carbonic oxide turns a light cherry-red colour, whilst ordinary blood becomes almost black.

L. DE K.

Chemical Detection of Carbonic Oxide in Blood. By LEO WACHHOLZ (*Chem. Centr.*, 1899, ii, 889; from *Vierteljahrschr. gericht. Med. öffentl. Sanitätswes.*, [iii], 18, 255—257. Compare preceding abstract).—The dextrose test may lead to erroneous results. The best process at present in use for detecting carbonic oxide in blood is the tannic acid process, proposed by Kunkel and modified by Schulz.

L. DE K.

Apparatus for the Estimation of Carbon Dioxide in Mineral Waters. By ALFRED HELD (*Bull. Soc. Chim.*, 1899, [iii], 21, 983—986).—The essential feature of the apparatus lies in the fact that the precipitation of the carbon dioxide by milk of lime and calcium chloride, the collection and washing of the precipitate, and the decomposition of the latter by dilute acid, are carried out in one and the same vessel, in an atmosphere free from carbon dioxide. For this purpose, the flask, in which the precipitation has been effected in the usual manner, is fitted with a cork bored with three holes, through which are passed: (1) A delivery tube, serving both for the admission of air free from carbon dioxide, and, subsequently, for the passage to the absorption apparatus of the gas liberated from the precipitated carbonate; (2) a tap-funnel for the inlet of water or acid; (3) a syphon tube, one limb of which reaches nearly to the bottom of the flask, and is connected by a cork to a small test-tube, pierced with several holes, and covered with a cap of filter paper. By means of this syphon, the liquid and washings are removed from the flask, leaving the precipitate to be treated with acid in the usual way.

N. L.

Estimation of Carbon Dioxide in Ammoniacal Gas-Liquor.

By F. CHEVALET (*Chem. Centr.*, 1899, ii, 847; from *Ann. chim. anal. appl.*, 4, 295—296).—The sample is allowed to run into an acid solution of cuprous chloride; the apparatus employed, which is a slight modification of the one introduced by Geissler, is weighed before and after the operation, and the carbon dioxide found by difference. The object of the copper solution is to retain hydrogen sulphide.

L. DE K.

Stutzer and Hartleb's Process for the Estimation of Combined Carbon Dioxide (Calcium Carbonate) in Soils.

By RUDOLF WOY (*Chem. Centr.*, 1889, ii, 847; from *Zeit. öffentl. Chem.*, 5, 400—401. Compare Abstr., 1899, ii, 521).—The author objects to the process, as decided quantities of ammonia are given off on boiling by the dissociation of the added ammonium chloride.

L. DE K.

Estimation of Silver on Plated Copper Utensils.

By JULIEN GIRARD (*Chem. Centr.*, 1899, ii, 975; from *Ann. chim. anal. appl.*, 4, 342—343).—The object is thoroughly cleansed and immersed in a liquid composed of 9 volumes of sulphuric and 1 volume of nitric acid; this rapidly dissolves the silver without acting appreciably on the copper. The silver may be ascertained from the loss in weight, or be estimated in the solution as chloride.

L. DE K.

Estimation of Small Quantities of Zinc in Organic Substances, especially in Apple Chips.

By KARL B. LEHMANN (*Zeit. anal. Chem.*, 1899, 38, 723; from *Arch. Hygiene*, 28, 291).—The substance is mixed with nitric acid and either incinerated until perfectly white, or after charring is mixed with sodium carbonate and potassium nitrate and fused in a porcelain basin. The ash is dissolved in nitric acid, copper precipitated by hydrogen sulphide, and the zinc then separated from iron, aluminium, and silica by repeated precipitation with ammonia. A small excess of acetic acid is added to the ammoniacal filtrate and the zinc thrown down by hydrogen sulphide. The zinc sulphide is then dissolved in hydrochloric acid and the zinc titrated by Fahlberg's ferrocyanide method (this Journ., 1875, 665) using a ferrocyanide solution of which 1 c.c. precipitates 0.1 milligram of zinc. The zinc solution must be only feebly acid; the presence of ammonium salts is harmless. For quantities of less than 1 milligram, a correction (about -0.15 mg.) must be applied.

M. J. S.

Titrimetric Estimation of Cerium.

By PHILIP E. BROWNING [with WM. D. CUTLER, G. A. HANFORD, LEO. A. LYNCH, and F. J. MALL] (*Zeit. anorg. Chim.*, 1899, 22, 297—307).—Accurate results are obtained with the following modification of Bunsen's method. The cerium dioxide is mixed in a stoppered flask with potassium iodide and a few drops of water, the air is then driven out by a current of carbon dioxide, pure hydrochloric acid added, and the flask stoppered and heated with steam for 1 hour, or until the dioxide is completely dissolved. The contents of the flask are then diluted, and the liberated iodine titrated with thiosulphate. The liberated iodine was also estimated by titration with arsenious acid after the contents of the

flask connected with an absorption apparatus were neutralised with potassium hydrogen carbonate, but in this case a loss of about 2 per cent. of the iodine occurred.

Cerium dioxide is only partially reduced by arsenious acid and cannot therefore be estimated by this reagent.

Stolba's method (Abstr., 1880, 749) by titrating the oxalate with permanganate, gives good results. A measured quantity of cerium chloride solution is precipitated with a known excess of ammonium oxalate and the precipitate separated by filtration and washed. The cerium oxalate is then dissolved in sulphuric acid and the oxalic acid titrated with permanganate. The excess of ammonium oxalate in the filtrate and wash-water is also titrated, the result giving a control to the titration of the cerium oxalate.

E. C. R.

Preliminary Tests for Clays. By WERNER CRONQUIST (*Chem. Centr.*, 1899, ii, 974; from *Oesterr. Zeit. Berg-Hütt.*, 47, 522—525).—Clays intended for the manufacture of crucibles should contain at most 47—72 per cent. of sand. This may be estimated with sufficient accuracy by first boiling the clay with hydrochloric acid, and then boiling the undissolved matter with a strong solution of sodium carbonate.

L. DE K.

Rapid Solution of Ignited Ferric Oxide in Hydrochloric Acid. By HUGO BORNTRÄGER (*Zeit. anal. Chem.*, 1899, 38, 774).—By adding to the hydrochloric acid a little iron-free manganese dioxide, even strongly ignited ferric oxide can be dissolved with great facility. This effect seems to be due to the chlorine evolved, since all the halogens facilitate the solution of ferric oxide in hydrochloric acid.

M. J. S.

Use of Hydrogen Peroxide in Quantitative Analysis. By CARL FRIEDHEIM and ERNST BRÜHL (*Zeit. anal. Chem.*, 1899, 38, 681—710).—After a review of the various proposals that have been made for the use of hydrogen peroxide in qualitative and quantitative reactions, the greater part of the paper is devoted to a study of the methods advocated by Jannasch and his pupils; separation of manganese from copper, zinc, and nickel, and of chromium from iron, aluminium, and manganese, by means of alkaline solutions of the peroxide (Abstr., 1895, ii, 331; 1896, ii, 220, 222, 546, 548). It is shown that the apparently satisfactory results obtained by Jannasch are largely due to compensating errors, none of the above separations being at all complete. The accuracy of the method of estimating manganese, in the absence of other metals, by precipitation with ammonia and hydrogen peroxide (Rosenthal, Abstr., 1887, ii, 923) is fully confirmed, but only in the absence of any considerable amount of ammoniacal salts. With increase in the proportion of ammonium salts, the amount of unprecipitated manganese increases, but at the same time the precipitate becomes more highly oxidised, so that apparently correct results may in some cases be obtained if the precipitate is regarded as Mn_2O_4 . Although alkaline solutions of

chromic oxide are oxidised by hydrogen peroxide, the oxidation is under no circumstances complete. This probably is the reason why chromium cannot by this method be separated from metals whose hydroxides are insoluble in alkalis. M. J. S.

Estimation of Thallium as Chromate. By PHILIP E. BROWNING and GEORGE P. HUTCHINS (*Amer. J. Sci.*, 1899, [iv], 3, 460—462).—Crookes having shown that thallous chromate is practically insoluble in water, the authors have applied this principle to the gravimetric estimation of thallium. The liquid containing the thallium is rendered distinctly alkaline by adding a solution of potassium carbonate, then heated to 80°, and precipitated with excess of potassium dichromate. The thallous chromate is collected on a Gooch's asbestos filter, washed, dried over a low flame, and weighed. Twelve test experiments prove the accuracy of the method. If precipitated in the cold, the precipitate is liable to run through the filter; this may be largely prevented by adding ammonium nitrate.

Moderately accurate results may be obtained by adding a known amount of potassium dichromate and titrating the excess with arsenious acid as described by Browning (*Abstr.*, 1899, ii, 73). L. DE K.

Ultimate Analysis of Organic Compounds. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1899, 129, 1002—1005).—For the estimation of the elements in an organic compound, the method employed by the author for the analysis of organic compounds and determination of their heat of combustion by burning the substance in a calorimetric bomb, is recommended as being simpler and more rapid than the methods in general use. For the estimation of sulphur, phosphorus, halogens, or metals in compounds poor in carbon, it is necessary to first mix the substance with camphor or naphthalene, so as to ensure easy combustion, and in the determination of the halogens, the presence of a small amount of sodium arsenite or sulphite solution in the calorimetric bomb ensures the conversion of the whole of the halogen into the corresponding hydrogen haloid.

H. R. L. S.

Estimation of Halogens in Organic Compounds. By AMAND VALEUR (*Compt. rend.*, 1899, 129, 1265—1267).—The calorimetric bomb may be employed in the estimation of the halogens in organic compounds (Berthelot, preceding abstract). When a compound containing chlorine is burnt in compressed oxygen in the presence of ammonium hydrate, the whole of the halogen is obtained as ammonium chloride, and may be estimated by the ordinary volumetric or gravimetric methods. Bromine is estimated in a similar manner. The combustion of an organic substance containing iodine is carried out in the presence of a concentrated solution of caustic potash; the latter, which contains the whole of the halogen, is decomposed with sulphuric acid and potassium dichromate, and distilled in order to recover the iodine, which is collected in potassium iodide solution and estimated volumetrically.

G. T. M.

Estimation of Benzene Vapour in Illuminating Gas. By OTTO PFEIFFER (*Chem. Centr.*, 1899, ii, 976; from *Journ. Gasbel.*, 42, 697—701).—Harbeck and Lunge's process of conversion into nitrobenzene is recommended (*Abstr.*, 1898, ii, 193). L. DE K.

Analysis of Ethereal Oils, especially the Citrus Oils. By ARTURO SOLDAINI and E. BERTÉ (*Chem. Centr.*, 1899, ii, 849—850; from *Boll. Chim. Farm.*, 38, 537—544).—These oils should conform to the following standards: *Oil of Lemon*.—Sp. gr. 0.854—0.860 at 15°. Rotatory power in 100 mm. tube +56° to +66° at 20°. Amount of citral above 6.5 per cent. On fractional distillation, the half which comes over first should show the same rotation as the original. Boiling point 171—172° under 760 mm., or 85—87° under 30—40 mm. pressure. In the absence of oil of bitter orange, the sample should not turn yellow on adding a solution of bromine in chloroform or sodium hydrogen sulphite.

Oil of Bergamot.—Sp. gr. 0.882—0.886 at 15°. Rotation at 20° +8° to +20°, generally +12° to +18°. Linanyl acetate, 34—42 per cent. Boiling point, 69° under 20—30 mm. pressure. Residue on evaporation, 5—6 per cent. Soluble in half its volume, or more, of 90 per cent. alcohol. No reaction with Schiff's test.

Oil of Bitter Orange.—Sp. gr. 0.847—0.853 at 15°. Rotation at 20°, +96° to +98°. Boiling point 173—174° under 760 mm., or 79—81° under 20—30 mm. pressure. On distillation, the rotation of the first (half) fraction is always 1° or 3° higher than the original, and it should not give a coloration with Schiff's reagent. L. DE K.

Valuation of Lemon-Oil. By J. WALTHER (*Chem. Centr.*, 1899, ii, 942—943, from *Pharm. Centr.-H.*, 40, 621—625).—The amount of citral and citronellal contained in lemon-oil is determined by converting them into oximes by means of hydroxylamine hydrochloride and then titrating the excess of this compound. A 20 per cent. solution of hydroxylamine hydrochloride in 80 per cent. alcohol is titrated first using methyl-orange and then phenolphthalein as indicator. An equal volume of the same solution is boiled with about 10 grams of lemon-oil and 0.5—1.0 gram of sodium hydrogen carbonate for 45 minutes. Hydroxylamine hydrochloride may be heated with the carbonate in presence of an indifferent liquid such as alcohol or turpentine without loss. The cooled solution is made up to 250 c.c. and 25 c.c. titrated with hydrochloric acid using methyl-orange, then back again with decinormal sodium hydroxide solution and finally again with alkali in presence of phenolphthalein. The percentages of citral c or of citronellal c' may be calculated from the formulæ $c = \frac{1.52a}{g}$ and $c' = \frac{1.54a}{g}$ in which a = c.c. of decinormal sodium hydroxide solution used, and g = weight of oil taken. By this method, lemon-oil was found to contain only 5 per cent. of citral, whereas according to Schimmel & Co., 7—8 per cent. is the usual amount. In order to avoid a large excess of hydrochloric acid, as little sodium hydrogen carbonate as possible should be used in the titration of hydroxylamine; the oximes are hydrolysed by an excess of acid,

forming ammonium citronellate and geraniate respectively, and these salts interfere with the titration.

The results were controlled by the following method. After forming the oximes, the product is made up to a certain volume, the oil separated, and the aqueous solution filtered. To 25 c.c. of the filtrate, after treating with 1 gram of sodium hydrogen carbonate, decinormal iodine solution was added, and the excess finally titrated with thio-sulphate solution. 1 c.c. of iodine solution corresponds with half a molecule of hydroxylamine.

E. W. W.

Lemon Flavouring Extract and its Substitutes. By A. S. MITCHELL (*J. Amer. Chem. Soc.*, 1132—1137).—10—20 c.c. of the extract is introduced into a kind of Babcock milk bottle of 80 c.c. capacity furnished with two necks. The larger tube, used for filling should enter at the side and pass almost to the bottom of the flask. The smaller tube, used for measuring the separated oil, should have an internal diameter of about 3 mm., and a length of about 12 cm.; the tube contains 1 c.c. between its extreme graduations, and is divided to fiftieths of a c.c., each division representing 0.2 per cent. of oil when 10 c.c. of the sample have been taken.

10 drops of hydrochloric acid and 30 c.c. of water are added and the flask placed in water at 70° until the oil separates; it is then filled with warm water and whirled in the centrifuge, when the oil collects in the neck. The separation is the more complete the richer the sample is in oil, but if only 5 per cent. or less is found, an allowance of 1.2 per cent. extra should be made. The oil may now be removed with a pipette and examined in the polariscope or the Zeiss butter refractometer. The rotation of oil of lemon in a 200 mm. tube, using a Schmidt and Haensch polariscope, is 63—64°, and its refraction at 30° varies from 67—72. Lemon substitutes give widely differing figures, which are recorded in a table. The rotations of alcoholic solutions of 5 and 1 per cent. strength of oil of lemon and its substitutes are also given.

To estimate the alcohol, 25 c.c. are pipetted into a 100—110 c.c. flask; 2 c.c. each of a saturated solution of aluminium chloride and sodium hydrogen phosphate are added, the mixture diluted to 110 and well shaken. 100 c.c. of the filtrate are diluted with 25 c.c. of water and then distilled until 100 c.c. have passed over, when the sp. gr. is taken.

L. DE K.

Estimation of Mercuric Oyanide. By E. VINCENT (*J. Pharm.*, 1899, [vi], 10, 537—539).—The mercury and the nitrogen in mercuric cyanide are simultaneously estimated by heating the salt with soda-lime, the mercury being collected and weighed in the metallic state, whilst the ammonia evolved is received in standard sulphuric acid. The method, which is both rapid and accurate, is also applicable to mercuric cyanate. Commercial specimens of the latter salt are usually very impure, and largely consist of mercuric cyanide mixed with more or less oxide.

N. L.

Detection of Nitroprussides in Cases of Poisoning. By GIUSEPPE VENTUROLI (*Zeit. anal. Chem.*, 1899, 38, 743—744; from *Bull. chim. farm.*, March, 1897).—Nitroprussides are highly poison-

ous; 12 milligrams of sodium nitroprusside killed a dog when injected under the skin. Nitroprusside could not be detected in the urine, it having been completely decomposed into nitrite and thiocyanate. It is therefore recommended that a suspected liquid should be boiled with ammonium sulphide and filtered, the filtrate, mixed with potassium hydroxide, evaporated to dryness, the residue treated with absolute alcohol, and the alcoholic extract examined for nitrite and thiocyanate by the usual tests. M. J. S.

Action of Strong Aqueous Soda on Methyl Acetate in the Presence of Methyl Alcohol and Acetone. By L. CUNIASSE (*Chem. Centr.*, 1899, ii, 975; from *Ann. chim. anal. appl.*, 4, 346—347).—Methyl acetate is but imperfectly decomposed by aqueous sodium hydroxide of sp. gr. 1.3, but its solution in methyl alcohol is completely decomposed by this alkali. Acetone dissolved in methyl alcohol is insoluble in ley of the above sp. gr., and separates. If methyl acetate is present, it is then not attacked by the alkali, and is found unaltered in the layer of acetone. L. DE K.

Estimation of Fusel Oil in Alcoholic Liquids. By ERNST BECKMANN [with H. BRÜGGEMANN] (*Chem. Centr.*, 1899, ii, 731—732; from *Zeit. Unters. Nahr. Genussm.*, 2, 709—714).—The process is briefly as follows: To the spirit some dry calcium chloride is added, and the fusel oil is then extracted by repeatedly shaking with carbon tetrachloride. This extract is shaken with water to remove any ethyl alcohol, and the amyl alcohol is then converted into amyl nitrite by passing through its solution a current of dry nitrous anhydride, the flask containing it being attached to a reflux condenser. The mixture is then boiled for a short time while transmitting a current of dry carbon dioxide, and, when cold, the nitric oxide generated by bringing it in contact with ferrous sulphate is liberated and measured in a Schulze-Tiemann's apparatus, and calculated into its equivalent of amyl alcohol. The presence of ethereal compounds in commercial spirits does not interfere with the process. L. DE K.

Estimation of Geraniol in Oil of Citronella. By SCHIMMEL & Co. (*Chem. Centr.*, 1899 ii, 880; from *Geschäftsber.*, Oct., 1899).—In the ordinary method of estimating the amount of geraniol in citronella oil by forming the acetyl derivatives and hydrolysing them, geraniol and citronellal are estimated together, the latter forming isopulegol acetate. In order to estimate geraniol separately, 2 grams of the oil are warmed on the water-bath for 2 hours with 2 grams of phthalic anhydride and 2 grams of benzene. The cooled product is shaken for 10 minutes with 60 c.c. of seminormal potassium hydroxide solution, the anhydride is converted into potassium phthalate, and the acid geraniol ester into the corresponding potassium salt. The excess of alkali is titrated with seminormal sulphuric acid. By subtracting the amount of potassium hydroxide used from the amount which corresponds with the quantity of phthalic anhydride added, the alkali equivalent to the phthalic acid combined with the geraniol is obtained,

and from this the percentage of geraniol may be easily calculated. The oil of citronella was found to contain 33 per cent. E. W. W.

Wood-Tar Creosote. By LYMAN F. KEBLER (*Chem. Centr.*, 1899, ii, 827; from *Amer. J. Pharm.*, 71, 409—413).—The amount of guaiacol contained in creosote is of importance in regard to its medicinal use, and may be determined as follows: 5 c.c. of creosote are mixed with 50 c.c. of a 20 per cent. alcoholic solution of potassium hydroxide. The crystalline mass, which separates in 10—30 minutes, consists of a compound of guaiacol and creosol with potassium. The dried crystals are heated for a moment with 5 c.c. of a 10 per cent. solution of sulphuric acid, the liquid is diluted, and the mixture of guaiacol and creosol, which separates as a heavy oil, removed. By treating this oil with 4 c.c. of a concentrated solution of ammonia, the guaiacol ammonium compound is formed as a crystalline mass which separates before the less crystalline creosol compound. The latter is removed by means of benzene, and the guaiacol ammonium compound decomposed by a 10 per cent. solution of sulphuric acid. The liberated guaiacol is dissolved by shaking with benzene and finally weighed after evaporating the solvent.

The amount of creosote and phenols contained in the tar may be estimated from the diminutive of volume of the tar after extracting with an aqueous solution of glycerol. E. W. W.

Estimation of Sugar in Diabetic Urine. By GUSTAVE PATRIN and E. DUFAU (*Bull. Soc. Chim.*, 1899, [iii], 21, 1028—1033. Compare Abstr., 1899, ii, 375).—The author has repeated the experiments of Pellet, who suggests the use of normal lead acetate instead of the basic salt for the precipitation of the proteids before estimating sugar in urine, and finds that, although more accurate results are thus obtained, certain proteid substances, especially peptones, escape precipitation, both by normal and basic lead acetate, the polarimetric results being thus rendered inaccurate. If, however, the proteids are precipitated by an acid solution of mercuric nitrate, accurate and concordant results are obtained both by Fehling's solution and by the polarimeter. The existence of laevorotatory sugars in diabetic urine is exceedingly doubtful; according to Béhal's experiments, the substance which interferes with the polarimetric estimation of sugar in urine is a laevorotatory proteid, which is precipitated by heat and by nitric acid, mercuric nitrate, and alcohol, but not by acetic acid, lead acetate, or magnesium sulphate. N. L.

Rapid Estimation of Sugar in Fatty Substances. By GIOVANNI POSSETTO (*Chem. Centr.*, 1899, ii, 977; from *Giorn. Farm. Chim.*, 49, 433—435).—The sugar is extracted by treatment with a definite volume of hot water, and estimated in an aliquot part of the clear filtrate by the usual methods. L. DE K.

Rapid Process for the Estimation of Starch: Estimation of Starch in Yeast. By D. CRISPO (*Chem. Centr.*, 1899, ii, 851—852; from *Ann. chim. anal. appl.*, 4, 289—290, 290—291).—3.391 grams of the sample of starch are rubbed with water and transferred to a 200 c.c. flask; 50 c.c. of a 6 per cent. solution of potassium

hydroxide are added, the whole diluted to about 150 c.c., and heated for an hour on a boiling water-bath, with frequent shaking. When cold, the solution is diluted to the mark, filtered repeatedly, and polarised in a 200 mm. tube. If a German polariscope is used, the number of degrees of rotation multiplied by six equals the percentage of anhydrous starch.

The process may be applied to the estimation of starch in commercial yeast. The starch is first removed from the yeast by lixiviation, and finally dissolved in potash. The results are, however, somewhat below the truth.
L. DE K.

Chemical Detection of Vegetable Fibres. By EDMOND JANDRIER (*J. Amer. Chem. Soc.*, 1899, 21, 1175—1176).—The sample to be examined for cotton, for instance, a piece of woollen goods, is, after careful washing, treated with sulphuric acid of sp. gr. 1.162 and heated for half an hour over the water-bath to convert the cellulose into soluble carbohydrates. The solution is diluted and a few c.c. are put into a test-tube containing about 0.01 gram of a phenol such as resorcinol. A little strong sulphuric acid is then gently poured down the side of the tube, when an orange colour will develop at the place of contact. *a*-Naphthol gives a purple, gallic acid a green gradually becoming violet, quinol and pyrogallol a brown, morphine and codeine a lavender, and thymol and menthol a pink colour.
L. DE K.

Separation of Lactic, Butyric, and Valeric Acids. By SCHNEIDER (*Zeit. anal. Chem.*, 1899, 38, 775—776; from *Zeit. angew. Mikroskopie*, 1897, 45).—The mixture is distilled with superheated steam, when butyric and valeric acids pass over, whilst lactic acid remains in the residue. The distillate is evaporated to dryness with calcium carbonate, and extracted with alcohol, when calcium acetate and formate remain undissolved. From the solution, zinc nitrate precipitates zinc valerate in thin plates, and from the concentrated filtrate copper nitrate throws down copper butyrate. To identify the lactic acid, the contents of the retort are evaporated with zinc oxide and filtered while hot; zinc lactate crystallises on cooling. A few centigrams of the zinc lactate are mixed with phosphoric acid and extracted with ether. The ethereal solution is evaporated, and a little cobalt acetate and lead acetate added. A precipitate is obtained of cobalt lead lactate in the form of colourless, hexagonal plates which are feebly levorotatory.
M. J. S.

Volatile Acids in Beer; Detection of Neutralising Agents in Beer. By EDUARD SPAETH (*Zeit. anal. Chem.*, 1899, 38, 745—769).—The acid reaction of normal beers is chiefly due to the presence of primary phosphates, with comparatively small quantities of volatile and non-volatile organic acids. In beer brewed with due regard to cleanliness and purity of yeast, a further development of acidity is extremely slow, and is mainly due to the production of volatile acid (acetic). In many small breweries, however, these precautions are not observed, and the conditions are often highly favourable to the access of the lactic acid bacterium. It is accordingly found that home-brewed beers, which have turned sour owe their increased acidity principally to the

development of lactic acid, whilst the amount of acetic acid is often scarcely greater than in normal beers. The proposal of Ott to recognise the fact of a sour beer having been neutralised with an alkali by estimating the volatile acids obtained by steam distillation before and after the addition of phosphoric acid, fails therefore to attain its object.

An estimation of the alkalinity of the ash of the beer will often indicate that the beer has been neutralised. The ash of 100 c.c. of normal beer rarely requires more than 0.3 c.c. of normal acid; a higher alkalinity is a qualitative indication, but for quantitative purposes the author has not been able to simplify his earlier process (Abstr., 1898, ii, 407). Prior's method (Abstr., 1893, ii, 53) seems also to be a trustworthy one.

M. J. S.

Detection of Glycuronic Acid in Urine. By PAUL MAYER (*Chem. Centr.*, 1899, ii, 450; from *Berlin klin. Woch.*, 36, 591—593).—See this vol., ii, 155.

Determination of the Bromine Absorption of Oils. By PARKER C. McILHINEY (*J. Amer. Chem. Soc.*, 1899, 21, 1084—1089. Compare Abstr., 1894, ii, 370).—The author has slightly modified his process. The oil is dissolved in carbon tetrachloride and a solution of bromine of known strength in the same solvent is added. The action of the bromine is complete in a few minutes; the bottle is placed in ice and solution of potassium iodide is introduced by the ordinary device. The excess of bromine liberates iodine, which is then titrated with *N*/10 solution of sodium thiosulphate.

If rosin or rosin oil is present, hydrogen bromide will be also formed; this is estimated by adding to the bleached liquid a solution of potassium iodate. This, in the presence of potassium iodide and the acid, liberates iodine, which is then again titrated and calculated into hydrogen bromide.

L. DE K.

Detection of Sesamé Oil. By A. BÖMER [with K. WINTER] (*Chem. Centr.*, 1899, ii, 729—730; from *Zeit. Unters. Nahr.-Genussm.*, 2, 705—709).—The author has investigated the properties of sesamin, one of the unsaponifiable constituents of sesamé oil, in which it occurs to the extent of 0.2—0.5 per cent. It is very soluble in chloroform but only slightly so in ether or light petroleum; by means of ether, it may be readily separated from phytosterol. The unsaponifiable portion of sesamé oil is first crystallised from alcohol and the crystals are then washed with small quantities of ether until the undissolved mass is free from phytosterol crystals. Sesamin is colourless, crystallises in large needles, or forms irregularly shaped, round crystals, and melts at 120—122°; when contaminated with phytosterol, the melting point may be as low as 110—112°. A mixture of equal parts of acetic anhydride and sulphuric acid added to sesamin causes a brownish-green, then bluish-green, finally dark cherry-red, or reddish-blue coloration. Sulphuric acid added to the chloroform solution turns cherry-red or blue, leaving the chloroform colourless; water does not discharge the colour. Its alcoholic solution turns violet on adding

sulphuric acid. Solutions of sesamin show a right-handed polarisation. It seems incapable of esterification.

Sesamé oil contains a small quantity of an active principle to which the Baudouin reaction, so characteristic of this oil, is due. This substance may be removed from the mother liquor of the crude phytosterol or even from sesamé oil itself by treatment with animal charcoal. From the charcoal, it may be recovered by treatment with ether; it then forms a pure brown or reddish-brown, resinous mass which still gives the Baudouin reaction in a dilution of 1:500,000. As this substance is affected by heat, care must be taken to avoid over-heating when testing margarine for sesamé oil.

L. DE K.

Milk Analyses: New Process for the Simultaneous Estimation of Residue, Fat, and Ash. By H. TIMPE (*Chem. Centr.*, 1999, ii, 977; from *Zeit. öffentl. Chem.*, 5, 413—416).—5 c.c. of milk are introduced into a weighed Gooch's crucible filled with asbestos and the residue is obtained by drying for 4—5 hours in an air-bath at 100—102°.

The fat is extracted with ether, the crucible being placed in a Soxhlet's apparatus, and the ash found by incineration.

L. DE K.

Determination of the Melting Point of Fats. By FERDINAND JEAN (*Chem. Centr.*, 1899, ii, 973; from *Ann. chim. anal. appl.*, 4, 331—334).—A platinum wire, such as is used for making borax beads, is dipped into the liquid fat and the bead allowed to cool for 4 hours. It is then attached to the bulb of a thermometer and suspended in a beaker containing water; heat is applied and the temperature is noticed first when the edges of the fat become translucent and then when the whole globule is transparent, the mean of the two observations being taken as the melting point. If the fat does not melt to a clear liquid, the wire is first bent like an 8, dipped into the fat, and when cold it is pulled straight. The temperature at which the fat detaches itself from the wire and floats on the water is taken as the melting point.

L. DE K.

Detection of Acetaldehyde in Ether. By HERMANN BLASER (*Chem. Centr.*, 1899, ii, 848; from *Pharm. Centr.-Halle*, 40, 607).—Instead of using a solution of magenta decolorised with sulphurous acid, the author takes a very weak solution of magenta (1:100,000) and bleaches this completely by exposure to sunlight. This solution gives very sharp reactions with aldehyde.

L. DE K.

[Detection of] Acraldehyde and certain other Aldehydes. By LOUIS LEWIN (*Ber.*, 1899, 32, 3388—3389).—Acraldehyde gives a gentian-blue coloration with a mixture of piperidine and a solution of sodium nitroprusside; very dilute solutions give a greenish-blue colour, but the reaction can be observed at a dilution of 1:3000; the blue colour becomes violet on adding ammonia, rose-violet to rusty-brown with sodium hydroxide, and brown with mineral acids, the blue colour returning on adding water. Dimethylamine can be used in place of piperidine, but is much less sensitive.

Acetaldehyde gives a similar blue coloration even at a dilution of 1:10,000, paraldehyde and propaldehyde at 1:1000, and cinnamaldehyde in alcohol solution a green to blue colour. Formaldehyde, trichloroaldehyde, isobutaldehyde, benzaldehyde, salicylaldehyde, phenylacetaldehyde, cinnamaldehyde and furfuraldehyde give no coloration with this reagent.

T. M. L.

Detection of Acetone in Urine and other Animal Secretions. By CARL OPPENHEIMER (*Chem. Centr.*, 1899, ii, 888—889; from *Berl. klin. Woch.*, 36, 38).—Denigé's process (*Abstr.*, 1899, i, 22; ii, 256) with mercuric sulphate containing excess of sulphuric acid is recommended. When applying the process quantitatively, the factor 0.055 should be substituted for 0.06 when calculating the weight of the mercurial acetone compound to acetone.

L. DE K.

New Methods in Indigo Assay. By ROBERT CLAUSER (*Chem. Centr.*, 1899, ii, 978—979; from *Oesterr. Chem. Zeit.*, 2, 521—523).—After pointing out the defects of the present methods, the author states that the best results are obtained by means of a slight modification of Schneider's naphthalene process.

0.3—0.5 gram of the powdered sample is mixed with quartz sand and extracted by means of 30—40 grams of boiling naphthalene. The naphthalene cake, which contains all the indigo, is then extracted in a specially constructed apparatus with 200 c.c. of boiling ether, and the indigo which is left undissolved is collected on asbestos and weighed.

L. DE K.

A New Alkaloidal Reagent. Detection of Opium. By MECKE (*Chem. Centr.*, 1899, ii, 683—686; from *Zeit. öffentl. Chem.*, 5, 351—354).—The reagent is made by dissolving 0.5 gram of selenous acid in 100 grams of sulphuric acid. A complete table and a lengthy description are given showing the action of the acid on the alkaloids in the cold and on warming.

By means of the intense bluish-green coloration given by the new reagent, it is possible to detect with certainty the presence of the rarer opium alkaloids in suspected cases of poisoning with that drug.

L. DE K.

48

General and Physical Chemistry.

Method for the Exhibition of the Properties of Polarised Light. By NICOLAI A. UMOFF (*Zeit. physikal. Chem.*, 1899, 30, 711—715).—The paper contains an account of a number of interesting lecture experiments. If a beam of plane polarised light is projected on to a glass cone with a vertical angle of about 68° , to the base of which is attached a paper screen, a circular disc of light is formed on the screen, by reflection from the glass, with two dark minima 180° apart, these showing the plane of polarisation. Various colour effects are obtainable by interposing plates of quartz, &c. By downward reflection of the beam into a glass jar of water, to which has been added a little alcoholic solution of resin, two dark lines down the opalescent liquid mark the plane of polarisation and one of the most interesting suggestions is the replacing of the water by a solution of sugar, &c., when spiral dark bands are obtained, illustrating the rotation of the plane of polarisation. L. M. J.

Spectrum of Silicon. By SIR NORMAN LOCKYER (*Proc. Roy. Soc.*, 1899, 65, 449—452).—A double line previously found in the spectra of gases distilled from the mineral eliasite was probably due to the fusion of the glass, and in reality belongs to silicon, of which element several other lines have now been detected. The silicon lines may be divided into three sets, no two of which behave alike under varying electrical conditions. It is found that the three sets of lines respectively attain a maximum intensity at the levels of stellar temperature represented by β , γ , and ζ Orionis. A line, however, at λ 3905.8, occurring in both arc and spark spectra, is not represented in the spectra of any of these stars. J. C. P.

New Lines in the Ultra-red of the Argon Spectrum. By RAFFAELE NASINI, FRANCESCO ANDERLINI, and ROBERTO SALVADORI (*Real. Accad. Lincei*, 1899, [v], 8, ii, 269—271).—By photographing the ultra-red portion of the spectra of various natural gases, including gas from a fumarole on Vesuvius and that of the Grotta del Cane, new argon lines of the following wave-lengths are detected : 798.0, 803.0, 814.0, 832.0, 845.0, and 857.5. T. H. P.

Reversible Photochemical Processes. By ROBERT LUTHER (*Zeit. physikal. Chem.*, 1899, 30, 628—680).—The changes investigated were the blackening of silver chloride and silver bromide ; this being attended with the liberation of halogen, it is probable that for any particular light intensity the products are in equilibrium when the pressure of the halogen reaches a certain value. In order to determine the relation between the light intensity and the halogen pressure, observations were made of the intensity necessary to cause blackening of glass plates coated with deposits of silver chloride and bromide, the deposits being in contact with halogen solutions of

varying strength, details of the method adopted being given. Curves are obtained for log. concentration against log. light intensity. The question is also investigated theoretically, and the author deduces an equation for the variation of the equilibrium constant with illumination, namely, $RT \cdot \{\log K_{\text{bright}} - \log K_{\text{dark}}\} = C/3 \sum a_x v_x (l_x - 1)$, where C represents the concentration of the light rays, and a_x , v_x , and l_x are the molecular coefficients, molecular volume, and the capacity function for radiations of the several substances entering into the reaction. Hence the equilibrium constant is unaffected by light only when this expression is zero; in general, the form is $\log K = AI + C$, where I is the light intensity and A and C are constants, but the experimental results are not in accord with these deductions. The E.M.F.'s of platinum electrodes in various illuminated halogen solutions, that is, the oxidation potentials of the solutions, were also determined, and the comparison of these values with the light intensity again shows no accord with the theories of either the author or of Luggin. No evidence could be obtained of a reverse process, that is, no light phenomena are obtainable by the chlorination of the darkened products. The values 1.44 and 1.14 volts were obtained for the E.M.F.'s of respectively bright and dark silver chloride electrodes in $N/10$ chloride solution. By determinations of the E.M.F. of a platinum electrode in a solution containing silver powder with varying quantities of chlorine or bromine, evidence was obtained of the existence of the compounds Ag_3OI and Ag_3Br , but no other compounds are indicated. Further work on the same question is promised by the author.

L. M. J.

Absorption of Röntgen's Rays by Aqueous Solutions of Metallic Salts. By LORD BLYTHSWOOD and E. W. MARCHANT (*Proc. Roy. Soc.*, 1899, 65, 413—428).—The absorption of normal solutions of salts with the same acid radicle increases with the atomic weight of the metal, although the increase in some cases, for example, calcium, strontium, and barium, is not very marked. Bromides and iodides are all highly absorbent, and of other salts nitrates, chlorides, and sulphates are placed in the order of increasing absorptive power. The absorption in a given thickness of salt solution is not proportional to the concentration, but follows approximately a logarithmic law. The amount of absorption varies logarithmically with the thickness of the solution traversed by the rays. The results are largely confirmatory of those obtained by Gladstone and Hibbert (*Abstr.*, 1897, ii, 131; *Chem. News*, 1898, 78, 199).

J. C. P.

Radiations from Radium. By HENRI BECQUEREL (*Compt. rend.*, 1900, 130, 206—211. Compare this vol., ii, 81, 125, 126).—The rays emitted by the chloride and carbonate of radium are equally deviated by the electro-magnet, the radiation from different specimens varying in intensity, but not in kind. The deviation produced by a given magnetic field remains constant, whether the experiments are made in air or in a vacuum. The remainder of the paper contains an account of physical experiments not suitable for abstraction.

G. T. M.

Dispersion of the Radiation of Radium in a Magnetic Field. By HENRI BECQUEREL (*Compt. rend.*, 1900, 130, 372—376. Compare this vol., ii, 126).—The author continues his researches on this subject, and describes various experimental improvements which enable him to obtain more definite results. N. L.

Electromotive Force and Chemical Equilibrium. By VICTOR ROTHMUND (*Zeit. physikal. Chem.*, 1899, 31, 69—78).—When k is the equilibrium constant of a chemical process which in a galvanic element originates the electromotive force E , then $E = RT \log_e k$: application of this general equation to the system:—metal | oxide | KOH | oxygen at atmospheric pressure | platinum, leads to the equation

$$\Pi = (L_m/c_m)^{1/n} \cdot (L_0/c_0)^4,$$

where Π is the dissociation pressure of the metallic oxide, n the valency of the metal, L_m and L_0 the electrolytic solution pressures of the metal and oxygen, c_m and c_0 the concentrations of the metal and hydroxyl ions respectively. When the solution is saturated with oxide, the product $c_m^{1/n} \cdot c_0 = \text{const.}$, so that the dissociation pressure of an oxide depends, not only on the electrolytic solution pressure of the metal, but also on a constant peculiar to the oxide. In general, however, the order of affinity of metals for oxygen will be determined by their electrolytic solution pressures.

The E.M.F. of the combination Pt | O₂ | NaOH | HgO | Hg is 0.159 volt; from this value, with the equation $E = RT \log_e \Pi$, the dissociation pressure Π of mercuric oxide is calculated to be $10^{-8.08}$ mm. of mercury at ordinary temperatures; this does not agree with the value calculated from Pélabon's numbers (*Abstr.*, 1899, ii, 423) and the heat of formation of mercuric oxide.

A theoretical connection is established between the dissociation constant of a gas and the electrolytic solution pressures of its components; thus it is shown that the dissociation of hydrogen iodide can be calculated from the electrolytic dissociation of aqueous hydriodic acid, Henry's partition coefficients, and the electrolytic solution pressures of hydrogen and iodine. The author urges investigation of the relation between various equilibrium constants, and advocates the use of ergo-chemical equations. J. C. P.

A New Kind of Transition Element. By ERNST COHEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 153—158; *Zeit. physikal. Chem.*, 1899, 30, 623—627).—Although below 20° the grey modification of tin is the stable one, yet the white modification may be supercooled, and an element may accordingly be constructed of the form:—Electrode of grey tin | Solution of a tin salt | Electrode of white tin. The E.M.F. will be $0.0001983 \frac{T}{n} \log_{10} \frac{P_g}{P_w}$ volt for this element where n is the valency of the tin, P_g and P_w the electrolytic solution pressures of the grey and white modifications respectively. Actual measurement of the E.M.F. showed that the ratio P_w/P_g was 1 at 20°, the transition temperature, and >1 at temperatures below 20°. Thus the white modification has the greater electrolytic solution pressure, and will precipitate grey tin from solutions of tin salts below 20°, a conclusion confirmed by experiment. This explains why a

solution of a tin salt is highly favourable to the conversion of the white into the grey modification.

When E_1 is the difference of potential between the grey tin and the tin solution in which it is immersed, i_1 the heat of ionisation of the grey tin, and $e_0 = 96540$ coulombs, then $E_1 = i_1/ne_0 + T.dE_1/dT$: a corresponding relation holds for the other electrode. Combining these with the equation $T.dD/dT = r_1/(V_w - V_g)$, where D is the external pressure, r_1 the heat evolved when 1 kilogram of white tin is converted into grey tin, V_w and V_g the volume in cubic metres occupied by 1 kilogram of the white and grey modifications, the author deduces the equation $dT/dD = 0.00105 A(V_w - V_g)/n(dE_1/dT - dE_2/dT)$, A being the atomic weight of the metal forming the electrode. J. C. P.

Theory of the Transition Cell of the Third Kind. By ERNST COHEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 334—342. Compare Abstr., 1898, ii, 276).—The general type of this transition element consists of two cells coupled in opposition—(a) electrode reversible with respect to the anion | saturated solution of a salt S in contact with the stable solid phase of the salt | electrode reversible with respect to the cation, and, (b) electrode reversible with respect to the anion | saturated solution of the salt S in contact with the metastable solid phase of the salt | electrode reversible with respect to the cation; S, for example, may be zinc sulphate, the transition temperature of the hydrates $ZnSO_4 \cdot 7H_2O$ and $ZnSO_4 \cdot 6H_2O$ being 39° . The temperature coefficient of this transition element at 39° is calculated in the following way. Differentiation of the equation $E = q(P - T)/P$, leads to $dE/dT = -q/P$, where E is the E.M.F. of the element, q the heat effect of the change involved, and P the absolute transition temperature of the change; q is calculated by extrapolation from Thomsen's figures, and also determined experimentally, leading to dE/dT at $39^\circ = -0.51$ millivolts. From Jaeger's values (compare Abstr., 1898, ii, 202) for the E.M.F. of Clark cells containing solid $ZnSO_4 \cdot 7H_2O$ or $ZnSO_4 \cdot 6H_2O$, it may be shown that dE/dT at $39^\circ = -0.55$ millivolts, agreeing well with the calculated coefficient.

The solubilities of both hydrates of zinc sulphate have been determined at temperatures between -5° and 39° , and results obtained agreeing closely with those of Callendar and Barnes (Abstr., 1898, ii, 276). J. C. P.

Alleged Identity of Red and Yellow Mercuric Oxides. I. By ERNST COHEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 273—281).—The E.M.F. of the system mercury | red mercuric oxide in caustic potash | yellow mercuric oxide in caustic potash | mercury has been very carefully determined by comparison with a standard cell at 25° . To begin with, the E.M.F. was 0.585 millivolt, but it increased to a maximum of 1.237 millivolts in about 24 hours, falling thereafter, and reaching a constant value, 0.685 millivolt, after 170 hours. When the oxides were previously shaken with water to remove soluble matter, and left in contact with the aqueous caustic potash before being put in the cell, the E.M.F. was constant from the first, and equal to 0.685 millivolt. It thus appears that red and yellow mercuric oxides are isomeric, contrary to Ostwald's view (*Zeit. physikal.*

Chem., 1895, 18, 159). The author's results are also at variance with those of Glazebrook and Skinner, according to whom a difference of 7 millivolt exists at 12° between the E.M.F. of Gouy standard cells made with the two oxides (*Phil. Trans.*, 1892, 183, 367). J. C. P.

Metallic Crystallisation by Electrical Transport of Certain Metals in Distilled Water. By THOMAS TOMMASINA (*Compt. rend.*, 1900, 130, 325—327).—When an electric current of less than 1 milli-ampère is sent through flat zinc electrodes placed in distilled water, the electrodes being very close to each other, well defined crystals of metallic zinc are deposited. At first, no gas is evolved, but after the action has been going on for some time, there is an evolution of gas from the cathode, the electrodes become oxidised, and the deposition of the metal ceases. If the anode is removed, cleaned, and then replaced, the action begins again. With a copper plate as cathode, and a zinc anode, crystals of zinc are deposited on the copper. Similar results were obtained with silver and cadmium. If the two electrodes are too widely separated, then a kind of haze appears between them; this contains very small, metallic crystals, which are arranged in a chain-like form. H. R. LÆ S.

Polarisation Phenomena observed in Quantitative Electrolytic Determinations. By HUGH MARSHALL (*Proc. Roy. Soc. Edin.*, 1899, 22, 532—538).—Attempts have been made to determine the time necessary for the complete electrolytic deposition of nickel, with varying current strengths, and different quantities of metal. With a cathode current density of 0.6—0.7 ampère per sq. decim., the time required for the deposition of 0.1—0.5 gram nickel was found to be 4 hours; the volume of the solution was 135 c.c., and it contained 5 grams each of ammonium sulphate and ammonia. In certain cases, the voltmeter showed a rise of 0.5 volt towards the end of the operation, and precisely in these cases was the deposition of the nickel complete. This rise of potential may, in fact, be taken as an indication that all the nickel has been deposited, as is shown by a number of test experiments.

The removal of the last traces of nickel from the solution is thus accompanied by an increased resistance between the electrodes. Experiment shows that, when the potential begins to rise, only 2—3 mg. of nickel remain in solution. When small quantities of nickel have to be estimated, it is advisable to use a small volume of solution and a small vessel, in which case the rise of potential above referred to is more marked and rapid. It remains to be seen whether this polarisation effect, probably due to a film on the cathode, can be trusted to appear in all cases. J. C. P.

Electrolytic Reduction of Potassium Chlorate. By ADOLPH L. VOOGH (*J. Physical Chem.*, 1899, 3, 577—601).—The investigations were made with the object of collecting data to serve as basis for a theory of electrolytic reduction. Electrolysis in acid and alkaline solutions showed that the percentage quantity of hydrogen used in the reduction is greater in the former than in the latter, and is, moreover, a function of the current, decreasing with increasing current density.

In the further experimental work, solutions in dilute sulphuric acid were chiefly used. The reduction varies with the metal employed as electrode, and was greater for zinc than for platinum, being also dependent on the physical structure; in the case of cadmium, the reduction efficiency did not alter with varying current density, so that this metal is less efficient than zinc for weak currents, but more efficient for strong currents. The effect of the acid concentration was determined, and it was found that the maximum efficiency was obtained for acid about $3/4$ normal, the potassium chlorate being about $1/2$ concentrated at 64° . Rise of temperature causes an increase of efficiency, the reduction being increased from 52 to 90 per cent. by a rise of from 25.6° to 81.1° . Potassium chloride was usually found in the anode liquid, but this was due entirely to diffusion from the cathode liquid, and not to any anodic reduction. A greater reduction than that due to the electrolytic hydrogen is sometimes obtained, this being most probably caused by the secondary action of the zinc on the potassium hydroxide, produced at the cathode, with the consequent formation of potassium zinc-oxide and hydrogen. Copper was found to readily dissolve in the acid solution of potassium chlorate, with no evolution of hydrogen, but with a 98 per cent. yield of potassium chloride; the electrolytic reduction with copper electrodes, however, is not as great as in the case of zinc electrodes.

L. M. J.

The Dilution Law. By WILDER D. BANCROFT (*Zeit. physikal. Chem.*, 1899, 31, 188—196).—The empirical formula $K = C_i^n/C_u$ is suggested as a general expression of the dilution law, where C_i and C_u are the volume concentrations of the dissociated and undissociated portions respectively; K and n vary for different electrolytes. By using Kohlrausch's numbers for ten strongly dissociated salts, and plotting $\frac{1}{2}\log C_i$ along one axis, and $\frac{1}{2}\log C_u$ along the other, the author shows that the curve obtained for each electrolyte is a straight line, and that n may be calculated in each case from the pitch of the curve; K may then be calculated for each dilution, and from the mean of the values so found the degree of dissociation which satisfies the equation $K = C_i^n/C_u$ may be calculated and compared with the observed value. A remarkably good agreement is obtained, except in the case of the most concentrated solutions; n varies from 1.36 for potassium chloride to 1.55 for silver nitrate. It is suggested that the generalised dilution law may give more accurate values for the dissociation in concentrated solutions than can be obtained from conductivity determinations.

J. C. P.

Molecular Susceptibility of the Salts of the Rare Earths. By STEFAN MEYER (*Ber.*, 1900, 33, 320—321. Compare du Bois and Liebknecht, this vol., ii, 127).—The author's values for the molecular magnetism of the series praseodymium, neodymium, samarium, gadolinium, and erbium, derived from a study of their dry compounds, indicates that their susceptibility coefficients have the following relative values: Pr : Nd : Sa : Gd : Er = 2 : 5 : 10 : 23 : 40, whilst from the data furnished by du Bois and Liebknecht from their determinations of the atomic magnetism in solutions of the salts of the rare earths, the following ratio is obtained: Pr : Nd : Sa : Gd : Er =

3:5:12:26:37. The discrepancy in the two series is probably due to the variable quantities of impurities present in the substances under examination, the paramagnetism of yttrium and ytterbium, for example, being almost certainly due to the presence of other elements.

G. T. M.

Molecular Susceptibility of the Paramagnetic Salts of the Iron Group. By OTTO LIEBKNECHT and A. P. WILLS (*Ber.*, 1900, 33, 443—445. Compare this vol., ii, 127).—Determinations of the magnetic susceptibility of 36 salts of the metals chromium, manganese, iron, cobalt, nickel, and copper have been made, and the results are indicated in tabular form. The salts of cobalt are placed next to those of iron on account of the close relationship existing between the magnetic properties of these elements, whether free or combined. When the series is arranged in this order, the molecular susceptibility attains its maximum at iron and manganese and falls to its minimum at copper. The susceptibility of the complete series of halogen salts was determined in the case of bivalent manganese, cobalt, and nickel; it was found to increase from the fluoride to the chloride and then fall to a minimum value for the iodide.

G. T. M.

Electrolytic Dissociation of Certain Salts in Methyl and Ethyl Alcohols, as Measured by the Boiling Point Method. By HARRY C. JONES (*Zeit. physikal. Chem.*, 1899, 31, 114—141).—In the various forms of boiling point apparatus, there are two defects: (1) too little attention is paid to the effect of radiation, (2) the condensed solvent is returned directly into the boiling liquid. An apparatus, resembling in some respects that of Hite (*Abstr.*, 1895, ii, 479), has been devised and used by the author, in which a cylinder of platinum foil is placed between the thermometer and the walls of the boiling tube; this reduces the effect of radiation, and prevents the condensed solvent coming in contact with the thermometer before it is reheated. The boiling tube is surrounded by an asbestos jacket, and rests on a piece of wire gauze, which is directly heated by the flame.

With this comparatively simple apparatus, the author has studied the effect of various dissolved substances on the boiling points of methyl and ethyl alcohols. Determinations with acetanilide, acetamide, diphenylamine, and triphenylmethane gave a mean value of 8.4 for the boiling point constant of methyl alcohol. Experiments then made with dissociating inorganic compounds allowed the degree of dissociation to be determined. The bromides and iodides of potassium and ammonium are dissociated to the extent of about 50 per cent., whilst the dissociation of sodium bromide and iodide is greater. Potassium and sodium acetates are dissociated to about 37 per cent., calcium nitrate to about 14 per cent. Most of the solutions contained 1/100th—1/50th of the molecular weight per 100 grams of solvent.

Generally, similar results were obtained with ethyl alcohol as solvent. The following degrees of dissociation were determined: potassium iodide 25—27 per cent., sodium iodide 31—33 per cent., sodium bromide 26—27 per cent., ammonium bromide 20—21 per

cent., sodium and potassium acetates 13—15 per cent., calcium nitrate 4—5 per cent.

Comparison of the dissociation of various inorganic compounds in water, methyl alcohol, and ethyl alcohol leads to the conclusion that there is not a proportionality between the dielectric constants of these solvents and their dissociating power, although the dielectric property seems to be the chief factor concerned. Other solvents with high dielectric constants, such as formic acid, allyl alcohol, acetone, nitrobenzene, *o*-nitrotoluene, will have to be investigated in order to settle the point satisfactorily.

J. C. P.

Specific Heats of some Organic Substances. By GUSTAVE FLEURY (*Compt. rend.*, 1900, 130, 437).—The specific heats of some dry clothing materials were determined, with the following results: cellulose, 0.366; wool, 0.393; leather, 0.357. In the ordinary moist state, these substances contain 7, 11, and 16 per cent. of water respectively, and the specific heats are: cellulose, 0.41; wool, 0.459; leather, 0.45.

N. L.

Atomic Weights and Physical Properties. By THOMAS BAYLEY (*Chem. News*, 1899, 80, 282).—The product of melting point (absolute) and coefficient of linear expansion has a nearly constant value 0.02 for certain elements. The value of α in the equation (specific heat) \times (melting point) = α (atomic weight) is given for a number of elements.

J. C. P.

Change in the Transition Point of Ammonium Nitrate at 32° through addition of Potassium Nitrate. By WOLF MÜLLER (*Zeit. physikal. Chem.*, 1899, 31, 354—359).—If t_0 and t_1 are the transition temperatures of ammonium nitrate before and after addition of potassium nitrate, and c is the molecular concentration of potassium nitrate in 100 grams of ammonium nitrate, the molecular depression of the transition point is $(t_0 - t_1)/c$; this molecular depression diminishes as the concentration of potassium nitrate increases, and the change takes place according to Rothmund's equation $t_0 - t_1 = RT^2/q \cdot (c_2 - c_1)$, where T is the absolute transition temperature of pure ammonium nitrate, c_2 and c_1 the molecular concentrations of potassium nitrate in 100 grams of the two modifications of ammonium nitrate, and q the heat of transition (compare Abstr., 1898, ii, 158). The results obtained seem to show that the transition of ammonium nitrate at 32° consists in a change of quadruple into triple molecules.

J. C. P.

New Method of Determining Transition Temperatures. By ERNST COHEN (*Zeit. physikal. Chem.*, 1899, 31, 164—175).—Systems which pass into each other are equally soluble at their transition temperatures. By measuring at various temperatures the electrical resistance of saturated solutions of the stable and metastable modifications, two curves are obtained connecting temperature and resistance, and these curves cut each other at the temperature of transition. An apparatus is described in which the preparation of the saturated solution and the measurement of the resistance can be conveniently made. The application of the method to the systems $\text{ZnSO}_4 + 7\text{H}_2\text{O}$ and $\text{ZnSO}_4 + 6\text{H}_2\text{O}$ gave for the transition temperature 39°, in agreement with the values obtained by other methods (Abstr., 1898, ii, 276;

this vol., ii, 184). The metastable form below 39° , $\text{ZnSO}_4 + 6\text{H}_2\text{O}$, is obtained by covering a solution saturated about 60° with a layer of paraffin oil, and allowing it to cool very slowly in a large water-bath.

The method is also employed for determining the resistance of a saturated copper sulphate solution at various temperatures; the curve connecting temperature and resistance shows in this case a slight discontinuity at 56° . A Daniell cell, in which a saturated copper sulphate solution is combined with a 5 per cent. zinc sulphate solution, shows a discontinuity in the E.M.F. curve at the same temperature. The author criticises Preece's (*Proc. Roy. Soc.*, 1883, 35, 48) and Carhart's experiments on the internal resistance of the Daniell cell.

J. C. P.

Partial Association of Liquid Molecules. By J. J. VAN LAAR (*Zeit. physikal. Chem.*, 1899, 31, 1—16).—A thermodynamical treatment of the subject with a number of involved calculations. The equation $(\text{H}_2\text{O})_2 \rightleftharpoons 2\text{H}_2\text{O}$ represents the equilibrium between the simple and double water molecules, and the association is accompanied by the absorption of 1930 cal. per 18 grams at 0 – 60° . For ethyl alcohol, a similar equation holds, whilst methyl alcohol and acetic acid are to be regarded as consisting partly of triple molecules.

The change of 18 grams of simple water molecules into double molecules is accompanied by an expansion of 8.44 c.c., the corresponding expansion for 46 grams of ethyl alcohol being 2 c.c.; the contraction which occurs in mixing water and ethyl alcohol therefore points to a decrease in the number of associated molecules. It is further shown that the partial association of the molecules explains the irregular thermal expansion of water.

J. C. P.

[Negative Heat of Formation of Alloys of Zinc and Copper]. By ALEXANDER GALT (*Proc. Roy. Soc. Edin.*, 1899, 22, 137—149 and 619—621).—By determining the heat of solution in dilute nitric acid of a powdered alloy and of a mixture of the two component metals in the same proportion, the heat of formation of the alloy may be ascertained. Copper-silver alloys shows little or no heat of formation. Copper-zinc alloys containing more than 30 per cent. of copper have a considerable positive heat of formation, but if the percentage of copper is less than 30, the heat of formation is negative.

J. C. P.

[Thermochemistry of] the Uric Acid Series. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1900, 130, 366—372).—The following determinations were made with the object of ascertaining the thermal effect of oxidation and methylation in the uric acid series.

Substance.	Heat of combustion.		Heat of formation.
	At constant volume.	At constant pressure.	
1-Methylpurine	820.88 Cal.	820.60 Cal.	- 47.74 Cal.
7-Oxypurine	583.57 "	582.69 "	+ 26.86 "
2-Oxypurine	592.47 "	591.59 "	+ 17.96 "
1-Methyl-7-oxypurine	760.08 "	759.49 "	+ 18.37 "

A comparison of these figures with the results previously obtained for xanthine (Abstr., 1899, ii, 400) shows that the conversion of 7-oxypurine (hypoxanthine) into xanthine and uric acid by the successive fixation of oxygen develops 69.8 Cal. and 51.4 Cal. respectively; from the former figure, the heat of formation of purine itself is calculated as -44 Cal. The decreasing development of heat for successive additions of oxygen is in accord with the results obtained in the indole series (*loc. cit.*). The conversion of hypoxanthine into 1-methylhypoxanthine is accompanied by the absorption of 13.5 Cal., instead of by the development of 5-6 Cal. as is commonly the case with homologous compounds; the difference between the heats of combustion (176.8 Cal.) is also greater than the normal (157 Cal.). Methylation is therefore accompanied by an increase in the energy of the system, just as is the case with the three methylxanthines, and Matignon's observations as to the anomaly exhibited by compounds in which the methyl group is directly united to nitrogen are confirmed. By deducting from the heat of formation of methylpurine the difference between the corresponding figures for hypoxanthine and methylhypoxanthine, the heat of formation of purine is found to be -34.2 Cal. as against the value -44 Cal. deduced above from the oxidation phenomena. N. L.

Heat of Dissociation of Violuric Acid and of Water. By RICHARD ABEGG (*Ber.*, 1900, 33, 393-394).—Guinchard has shown (Abstr., 1899, i, 781) that the dissociation constant of violuric acid increases rapidly as the temperature rises; from his values, the heat of dissociation can be calculated by van't Hoff's formula, the mean value being about -3700 Cal. This is about 10 times as great as the values obtained with acetic and other weak acids, and confirms the view that the ionisation is accompanied by an (endothermic) isomeric change.

In a similar way, the high value of the heat of dissociation of hydrogen fluoride (-3550 Cal.), when compared with hydrogen chloride (-1080 Cal.) and hydrogen bromide (-1617 Cal.), is an indication that the ionisation is accompanied by the dissociation of H_2F_2 into $2HF$.

The heat of dissociation of water into the ions H^+ and OH^- is very large, amounting to -13000 Cal., and this is regarded as due in part to its high association factor, the complex molecules $(H_2O)_x$ being broken down into xH_2O in the ionisation. T. M. L.

Antimony Trichloride in Cryoscopy. By STANISLAW TOLLOCZKO (*Zeit. physikal. Chem.*, 1899, 30, 705-710).—According to the views of Brühl (Abstr., 1899, ii, 10), the dissociating power is due to incomplete saturation of the solvent, and if so, marked dissociation should be found for solutions in antimony trichloride, a compound which, owing also to its convenient freezing point, is well adapted for cryoscopy. The cryoscopic constant was found to be 184 by determinations of the depressions produced by xylene, anthracene, diphenylmethane, acetophenone, and benzophenone; this high constant, ten times that of water, indicates a latent heat of fusion of 12.9 cal. With potassium chloride and potassium bromide, indications of consider-

able dissociation were obtained, increasing with dilution, the value 0.69 being obtained for the bromide at a concentration of about 0.2 per cent. Brühl's views have hence, in this case, been confirmed (see, however, Kahlenberg and Lincoln, *Abstr.*, 1899, ii, 397). The author points out the suitability of the substance as a solvent for cryoscopic determinations of the molecular weight of organic compounds, which are for the most part soluble in it.

L. M. J.

Real and Apparent Freezing Points and Cryoscopic Methods. By MEYER WILDERMANN (*Zeit. physikal. Chem.*, 1899, 30, 577—585. Compare *Abstr.*, 1896, ii, 290).—The paper, much of which has been previously published, is essentially a recapitulation of the errors inherent in freezing point determinations. Even if the instruments are absolutely accurate, and if no accidental extraneous errors exist, the freezing point observed is not the true freezing point, but a temperature dependent on the velocity of precipitation or of melting of the ice, the rate of cooling, and the variation from the convergence temperature. Identity of results obtained under similar conditions is thus no indication that these yield the true temperatures desired, so that repetition of experiments leads to no final accuracy. As the errors are functions of the temperature, the observed depressions are also inaccurate, and it is only by determining the magnitude of each effect, and correcting for it, that really trustworthy determinations of freezing points and cryoscopic depressions can be obtained. Examples are given where neglect of this may lead to errors of 6 to 12 per cent. The same reasoning applies also to determinations of boiling points and other constants, but these are not further considered (compare this vol., ii, 131).

L. M. J.

Thermokinetic Properties of Solutions. By LADISLAUS NATANSON (*Zeit. physikal. Chem.*, 1899, 30, 681—704).—A purely mathematical paper, in which the author discusses, from a thermodynamical standpoint, a system consisting of a mixture separated from a pure substance, but in which the passage of one component in either direction is permitted. When the pure substance is one component of the mixture, the case reduces to one of a solvent separated from a solution by a semipermeable partition, and two values are deducible for the osmotic pressure, according to the component which is regarded as the solvent. In a solution, therefore, there are two osmotic pressures and it should not be impossible in certain cases, as for two miscible liquids, to experimentally verify this.

L. M. J.

Liquefaction of Gaseous Mixtures. By F. CAUBET (*Compt. rend.*, 130, 167—169).—Curves representing the tension of saturated vapour against temperature are given for methyl chloride, carbon dioxide, and ten different mixtures of these compounds, the determinations being carried to the critical temperature; the tangent to each curve at its critical point forms the critical line for these mixtures. Retrograde condensation is observed under those conditions represented by the portion of each curve to the right of the critical ordinate, the most favourable conditions for the observation of the

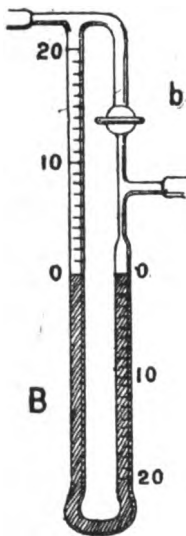
phenomenon being when this portion is greatest. In the mixtures examined, this is the case for those containing 32.2 and 40.4 per cent. of methyl chloride, where it occurs within temperature limits of 5°. Where comparable, the results are in good accord with those of Kuenen, as is seen by the comparison of the author's results for the mixture containing 59 per cent. methyl chloride with Kuenen's results for the mixture containing 61 per cent. of the same compound.

L. M. J.

Deviations from Boyle's Law of Mixtures of Hydrogen and Carbon Dioxide. By J. E. VERSCHAFFELT (*Zeit. physikal. Chem.*, 1899, 31, 97—102).—For mixtures of hydrogen and carbon dioxide, the author finds that the values of the coefficient m_1 in the equation: $pv = RT + m_1/v + m_2/v^2 +$, &c., can be calculated from the formula: $m_1 = 0.00074x^2 - 0.0012x(1-x) - 0.0063(1-x)^2$, where x represents the ratio of the number of hydrogen molecules to the total number of molecules of the mixture. The experimental numbers for m_1 show good agreement with the calculated values.

At 18°, mixtures of these gases obey to the second approximation the law: $pv = 1.067 + m_1/v = 1.067(1 + 1/v \cdot m_1/1.067)$; the expression within the brackets, which is equal to $1.00069x^2 + 1.9989x(1-x) + 0.9941(1-x)^2$, is greater than unity for hydrogen (that is, when $x=1$) less than unity for carbon dioxide ($x=0$), and equal to unity for the value $x=0.795$. So that for a mixture of composition represented by this value of x , Boyle's law is obeyed to the second approximation.

T. H. P.



Determination of Vapour Density under Arbitrary Pressure. II. By OTTO BLEIER and LEOPOLD KOHN (*Monatsh.*, 1899, 20, 909—925. Compare Abstr., 1899, ii, 643).—Several improvements in this method are announced. Instead of an air-pump, it is now recommended that a mercury pump should be used, so that the determination may be started under a pressure of only 2—3 mm. The bulb in which the vaporisation of the substance takes place should be of 400—500 c.c. capacity. Determinations can be carried out in which the increment of pressure is only about 5 mm. Such small increments of pressure are not conveniently measured by means of the manometer previously described (*loc. cit.*), which is replaced by the special form of differential manometer here figured. It is filled with paraffin oil instead of mercury, so that the "difference" on the manometer is about 17 times as great as

it would be were mercury used and can be easily read off by the unaided eye. The upper end of this manometer is attached to a large flask which is provided with two stopcocks and an ordinary manometer and acts as a "vacuum reservoir." Determinations are carried out as follows: The substance is first placed in the neck of the bulb, which is then

heated in the required bath. The apparatus, with the stopcock of the manometer open, is then exhausted by the pump till the required diminution of pressure is obtained. The stopcock of the manometer is then closed and that of the vacuum reservoir opened (this reservoir having been previously exhausted). The substance is allowed to fall into the bulb and the "increment" of pressure occasioned by its vaporisation is directly read off after an interval of not more than 4 minutes. The air is let into the apparatus again by means of a slit in the stopcock between the "reservoir" and the manometer, which in one position allows air to pass into the manometer, but not into the "reservoir."

This procedure further appears to afford a means of determining whether a substance undergoes dissociation, for in such cases the increment of pressure is only slowly, whilst in normal cases it is rapidly (1—4 min.), shown.

The results of the large number of determinations quoted, using baths of water, toluene, xylene, and aniline, all agreed with the theoretical value to within 2 per cent.

R. H. P.

New Pyknometer for the Determination of the Specific Gravity of Light Liquids. By HEINRICH GÖCKEL (*Zeit. angew. Chem.*, 1899, 1194—1195).—This is a pyknometer bulb, sealed to a massive glass foot, which supports the instrument in an upright position when placed in water in order to acquire a definite temperature. L. DE K.

Molecular Volume of Camphor Derivatives. By ALBIN HALLER and PAUL TH. MÜLLER (*Compt. rend.*, 1900, 130, 221—224. Compare Abstr., 1899, i, 622, and this vol., i, 182).—The molecular volumes of a series of camphor derivatives dissolved to a $N/4$ solution in toluene were obtained by direct experiment and by the employment of the following expression: $V = \bar{M} + S/d - S/d'$, where \bar{M} , is the molecular weight of the compound, S the weight of solvent containing one molecular proportion of the dissolved substance, and d and d' the specific gravities of the solution and solvent respectively. These constants may also be calculated from Traube's formula, $V = \Sigma a - N - L + C$, where N is a coefficient depending on the number of hexamethylene rings in the molecule, L a coefficient proportional to the double linkings, C the co-volume, and Σa the sum of the atomic coefficients. It is found that the calculated values are always greater than those obtained by experiment, the difference being the sum of the decrements due to the closed chains other than hexamethylene rings present in the molecule.

In the case of methyl camphorate which contains one additional ring, the decrement is 17.6, whilst with camphor, borneol, methyl camphor-carbonate, benzylidenecamphor, benzylcamphor and their homologues, the mean value of the decrement due to two camphor nuclei is 23, the extremes being 20.6 and 25.4. Piperonylidenecamphor and piperonylcampmor contain, in addition to the camphor nuclei, an additional piperonylic ring; this increases the decrement by 6 units, the mean value of this coefficient being 29.

Bornyl succinate contains two camphor residues, and the decrement

is 33.2; this result indicates that the effect produced by four closed chains is not double that produced by two, and therefore the law of the addition of nuclear decrements is not absolutely general. G. T. M.

Surface Tension of Organic Liquids. By PAUL DUTOIT and LOUIS FRIDERICH (*Compt. rend.*, 1900, 130, 327—330. Compare Abstr., 1899, ii, 350).—The following values of k , the temperature coefficient of molecular surface energy, were determined by the method of Ramsay and Shields:

m-Xylene, 2.20; mesitylene, 2.15; durene, 2.14; pentamethylbenzene, 2.165; aniline, 1.60—2.05; methylaniline, 1.99—2.08; ethylaniline, 2.22; dimethylaniline, 2.39; diethylaniline, 2.34; *o*-toluidine, 2.05; *p*-toluidine, 1.72; dimethyl-*o*-toluidine, 2.53; diphenylamine, 2.57; acetonitrile, 1.50—1.56; propionitrile, 1.67—1.74; butyronitrile, 1.89; *p*-toluonitrile, 1.88—2.05; hexane, 2.11; diphenyl, 2.22; naphthalene, 2.29; acenaphthene, 2.31; diphenylmethane, 2.25; *s*-diphenylethane, 2.49; pyridine, 2.17; quinoline, 2.43; acetone, 1.83; methyl ethyl ketone, 1.85; acetophenone, 2.14; benzophenone, 2.63.

The following conclusions are drawn: (1) the value of k varies with the temperature for abnormal liquids, but not for normal liquids; (2) for normal liquids, the value of k is not constant, but varies within limits the range of which is greater than was formerly supposed.

H. R. Ls S.

Nernst's Osmotic Experiment and a Definition of Osmotic Pressure. By A. CRUM BROWN (*Proc. Roy. Soc. Edin.*, 1899, 22, 439—440).—An osmotic cell of Nernst's type (Abstr., 1890, 1365) may be formed with three liquid layers as follows: (1) water + phenol + calcium nitrate, (2) phenol + water, (3) water + phenol. If (1) is lowermost, and (2) lies above it, then the layer (2), being impermeable for calcium nitrate, gradually rises as water diffuses from (3) to (1).

If two partially miscible liquids A and B are shaken up under the pressure p , and a given solution of a substance N in A is shaken up with B under the pressure p' , the solutions of A in B formed in the two cases will have the same concentration if $p' - p$ is equal to the osmotic pressure.

J. C. P.

Theory of Diffusion. By OTTO WIEDEBURG (*Zeit. physikal. Chem.*, 1899, 30, 586—592).—The author criticises certain tacit assumptions in Bose's paper on the "Theory of Diffusion" (Abstr., 1899, ii, 729), and deduces other expressions. For sufficiently low concentrations, these reduce to one previously obtained empirically, $D = D_0(1 + \gamma c)$, where D_0 and γ are constants, the latter being capable of positive or negative values as the diffusion coefficient may either decrease or increase with dilution. The value for D_0 is $RT.2uv/u + v$, where u and v are the velocity of anion and cation respectively; γ has the value $2/k \cdot \{w \cdot (u + v) / 2uv - 1\}$ where w is the velocity of the undissociated molecule and k the dissociation constant. When γ and k are small, therefore $1/w = \frac{1}{2}(1/u + 1/v)$ and is otherwise calculable where the other constants are known. The values of w and of D_0 are so

calculated for copper sulphate, but the results do not agree with those obtained by extrapolation from measurements of the diffusion.

L. M. J.

Osmotic Pressure of Concentrated Solutions. By THOMAS EWAN (*Zeit. physikal. Chem.*, 1899, 31, 22—34).—When P is the osmotic pressure at the temperature T of a solution of 1 gram of sucrose in m grams of water, thermodynamical considerations lead to the relation:— $Pv_0/JT = W_0(1/F - 1/T_0) - c/2.(T_0 - F)^2/F^2 - dQ_T/dm.(1/F - 1/T) + C_L/2.(T - F)^2/F^2$, where v_0 is the increase of volume accompanying dilution, J the mechanical equivalent of heat, F the freezing point of the solution, W_0 the latent heat of fusion of water at its freezing point T_0 , c the difference between the specific heats of water and ice, dQ/dm the heat of dilution, and C_L the temperature coefficient of the heat of dilution.

The freezing points of several sucrose solutions containing from 30—70 grams of sucrose per 100 grams of water have been carefully determined. The molecular depressions obtained are satisfactorily given by the equation $t/g.342 = 18.58 + 0.97t$, where t is the depression of the freezing point in a solution containing g grams of sucrose in 100 grams of water. The formula gives values about 1 per cent. smaller than those of Raoult (*Abstr.*, 1899, ii, 203).

As regards the heat of dilution, it is found that if Q be the heat developed when a solution of 1 gram of sucrose in 0.6051 gram of water is diluted until it contains m grams of water to 1 gram of sucrose at about 14° , $Q = 1.25(m - 0.6051)/(0.6 + m)$, whence $dQ/dm = 1.506/(0.6 + m)^2$. Equations are also given for calculating the temperature coefficient of dQ/dm and v_0 .

Of various empirical formulæ representing $(dP/dT)_r$ as a function of the concentration, the most satisfactory was found to be $(dP/dT)_r = R/[V - (V - nM_0v_0)/m]$, where V is the volume of solution containing 342 grams of sucrose and nM_0 grams of water; nM_0v_0 is the increase of volume that would occur if nM_0 grams of water were added to the solution without appreciably changing its concentration. $V - nM_0v_0$ is a measure of the volume occupied by the sucrose, and experiment shows it to be nearly constant: the quantity $(V - nM_0v_0)/m$ corresponds with the b of van der Waals's equation.

On the supposition that the dissolved substance does not polymerise or dissociate, an expression is obtained for calculating the molecular weight from the freezing point depression in a concentrated solution; with this expression, values are obtained for the molecular weight of sucrose not differing greatly from 342.

J. C. P.

Hydrates in Solution. By WILDER D. BANCROFT (*J. Physical Chem.*, 1899, 3, 551—554).—Nernst, in his "Theoretische Chemie," considers only very briefly the case in which the solvent actually takes part in the reaction, and there deduces that, in a dilute solution, the percentage of the hydrated substance is independent of concentration. This, however, only holds when no secondary electrolytic dissociation takes place, and the author therefore extends the case to hydrated salts. If A be the total concentration of the salt, c that of the water, x the anhydrous dissociated salt, and y the amount of dissociated salt,

the equilibrium equations are (for a binary salt) $Kx/v = (y/v)^2$ (1); $K_1(A - x - y)/V = x/v \cdot (c/v)^n$ (2); hence by regarding c/v as constant, that is, for dilute solutions, is obtained $K_2(A - x - y)v = (y/v)^2$ (3), from which follows a decrease of hydration by dilution, so that hydrated salts are decomposed by water. By combination of (1) and (3), with elimination of x , there results $K_3(A - y)/v = (y/v)^2$, which is the ordinary dilution law of Ostwald; so that this law is valid for hydrated salts, and the variations are not accounted for by the assumption of hydrates. Cases are considered also where one ion is hydrated, or where only the hydrated salt is an electrolyte, but no essential difference results.

L. M. J.

Solid Solutions and Isomorphous Mixtures. By GIUSEPPE BRUNI (*Real Accad. Lincei*, 1899, [v], 8, ii, 212—219).—A polemical paper in which Bodländer and Küster's views concerning the different behaviour of solid solutions and isomorphous mixtures are combated.

T. H. P.

Reciprocal Solubility of Liquids. By GIUSEPPE BRUNI (*Real Accad. Lincei*, 1899, [v], 8, ii, 141—149).—The author has studied the mutual solubility of water and methyl ethyl ketone in presence of 1.5 per cent. of alcohol. The curve obtained, which is the section of the dimeric surface by a plane parallel to one side of the triangular diagram, is closed and shows that mixtures of water and methyl ethyl ketone in presence of 1.5 per cent. of alcohol can only form two distinct layers at temperatures lying between $+16^\circ$ and $+148^\circ$. For the upper part of the curve, the diameter parallel to the axis of concentrations is nearly a straight line, whilst for the lower portion this is no longer the case.

The freezing point curve for the same mixture has also been determined and is found to have no point in common with the liquid solubility curve. This has never before been observed with curves representing states of stable equilibrium.

T. H. P.

Solubility of Ethyl Acetate in Aqueous Salt Solutions. By HANS EULER (*Zeit. physikal. Chem.*, 1899, 31, 360—369).—Ethyl acetate is less soluble in salt solutions than in pure water. The equivalent diminution of solubility is represented by the expression $(0.825 - l)/m$, where 0.825 is the solubility (in gram-molecules per litre) of ethyl acetate in pure water at 28° , and l its solubility in a salt solution of the concentration m . The value of this expression has been determined for a number of salt solutions of various concentration, and the results resemble those obtained by Roth for the solubility of gases in salt solutions (*Abstr.*, 1898, ii, 18). Thus the equivalent diminution of solubility increases with the dilution of the salt solution, and when the various salts are arranged according to their values for the above expression, the order is the same whether the dissolved substance be hydrogen, nitrous oxide, or ethyl acetate. Comparison of the results obtained in these three cases shows that the percentage diminution of solubility increases with the solubility of the compound investigated.

J. C. P.

Gibbs' Phase Rule. By C. H. WIND (*Zeit. physikal. Chem.*, 1899, 81, 390—397).—A proof of the phase rule, not suitable for abstraction. The author claims to have arrived at a clear formulation of the phase rule with a minimum of initial hypothesis. J. C. P.

Application of the Phase Rule to Alloys and Rocks. By HENRI LE CHATELIER (*Compt. rend.*, 1900, 130, 85—87).—The successive reversible changes which a mixture of molten solids may experience during cooling at constant pressure, such as solidification, crystallisation, separation of solid phases, &c., must finally lead to a univariant system, in which the number of phases is equal to the number of independent constituents, and as an example the cooling of a molten mixture of iron and carbon is considered. As a natural example, granite is cited; here the independent constituents are three in number—silica, alumina, and potash, whilst three phases are also present, namely, quartz, felspar, and mica. If, in a mass thus obtained, there is present a greater number of phases, then the operations leading to its formation are not reversible and the mass is not in stable equilibrium. The principal cause of such unstable systems is too rapid cooling and in alloys a characteristic is that the properties are very variable and dependent on the conditions of preparation.

L. M. J.

Physical Equilibrium in Mixtures of Isomorphous Substances. By GIUSEPPE BRUNI and F. GORNI (*Real. Accad. Lincei*, 1899, 8, ii, 181—190. Compare Abstr., 1899, ii, 356, and 731).—Freezing point curves have been traced for the following mixtures of isomorphous compounds. (1) *p*-Dichlorobenzene (m. p. 52·7°) and *p*-chlorobromobenzene (m. p. 67·0°). (2) *p*-Dichlorobenzene and *p*-dibromobenzene (m. p. 85·9°). In each of these cases, the gradual addition of the component of higher melting point to the other causes, firstly, a lowering of the freezing point, which afterwards rises, the curves being continuous. (3) *p*-Chlorobromobenzene and *p*-dibromobenzene. In this case, the freezing point rises continuously when the component of higher melting point is added to the other. (4) Azobenzene and dibenzyl. On adding azobenzene to dibenzyl, depression of the freezing point takes place until about 30 per cent. of the former is present, after which the curve runs horizontally for some distance and then rises.

Mixtures of cinnamic and phenylpropionic acids give a freezing point curve similar to that given by most isomorphous mixtures, although these acids have crystalline forms which are in no way simply related.

It is concluded that no difference in kind, but only in degree, exists between the freezing point curves of isomorphous mixtures and those of solid solutions of non-isomorphous substances.

The following crystallographic data, from measurements by G. Boeris, are given. *p*-Dibromobenzene: monoclinic [$a : b : c = 2·6660 : 1 : 1·4179$. $\beta = 67°22'$]. *p*-Chlorobromobenzene: monoclinic [$a : b : c = 2·6077 : 1 : 1·4242$. $\beta = 67°0'$]. Phenylpropionic acid: monoclinic [$a : b : c = 1·6054 : 1 : 0·5552$. $\beta = 78°47'$]. T. H. P.

Equilibrium between Sulphuric Acid and Sulphates in Aqueous Solution. By SYDNEY A. KAY (*Proc. Roy. Soc. Edin.*, 1899, 22, 484—522).—The amount of free acid in a mixed solution of sulphuric acid and a normal sulphate has been determined by measuring the rate of catalysis of ethyl acetate, a correction being applied for the influence of the normal salt on the catalytic action of the acid.

The equilibrium may be represented by an equation of the form $[c_1(1 - \alpha_1)]^{0.85}/[c_2(1 - \alpha_2)] = A/[c_3(1 - \alpha_3)]^x$, where c_1, c_2, c_3 are the total concentrations of sulphuric acid, normal sulphate, and acid sulphate respectively, and α_1, α_2 , and α_3 the corresponding degrees of dissociation; x is equal to unity for potassium sulphate, and has the value 1.35 for sodium and lithium sulphates. The constant A has a characteristic value in each case, and in the expressions involving potassium, sodium, and lithium sulphates has the values 0.259, 0.0618, and 0.060. The expression gives results agreeing well with those actually observed.

J. C. P.

Reciprocal Salt Pairs. II. Equilibrium Phenomena in Presence of a Double Salt. By WILHELM MEYERHOFFER and A. P. SAUNDERS (*Zeit. physikal. Chem.*, 1899, 31, 370—389).—A continuation and expansion of the work recorded in an earlier paper (*Abstr.*, 1899, ii, 410). The change of the system $K_2Na(SO_4)_2 + NaCl + Na_2SO_4 \cdot 10H_2O$ at 16.3°, consisting in a dehydration of the sodium sulphate, is fully considered, and the conditions of existence of hydrated sodium sulphate determined and graphically represented. Distinction is drawn between congruent and incongruent cryohydrates; the former solidify regularly, whether solid is present or not, whilst with the latter, the presence of a certain quantity of solid salt is necessary.

It is pointed out that, in many cases of secondary transition, a better review of the phenomena is secured by the use of van't Hoff's theory than by the application of the phase rule.

J. C. P.

Characteristics of certain Chemical Reactions. By JOHN GIBSON (*Proc. Roy. Soc. Edin.*, 1898, 22, 33—37).—The chemical behaviour of hydrochloric, nitric, and sulphuric acids is shown to differ in several special cases, according as the acid is above or below the strength corresponding with maximum conductivity. The author reviews the general connection between chemical reactions and conductivity, and states as a working hypothesis that the degradation of potential chemical energy is generally associated with molecular rearrangement involving diminished electrical resistance.

J. C. P.

Velocity of Graded Actions. By JAMES WALKER (*Proc. Roy. Soc. Edin.*, 1898, 22, 22—32).—When a reaction takes place in two stages, the theory of mass action in its usual form will be applicable only if one stage of the reaction takes place in a very short time as compared with the other. Otherwise it may be shown that, when the two reactions involved are non-reversible and unimolecular,

$$x = A\{1 + ne^{-nt}/(m - n) + me^{-nt}/(n - m)\},$$

where z is the quantity of the final substance, and m and n are the velocity constants of the two separate reactions. The error introduced by calculating z as if the reaction took place in one stage instead of two, depends, of course, on the relative value of m and n , and for the relation $n = 100m$ is of small account except at the beginning of the action.

J. C. P.

Numerical Laws of Chemical Equilibrium. By OCTAVE BOUDOUARD (*Compt. rend.*, 1900, 130, 132—134).—In a gaseous system in equilibrium there exists at all temperatures and pressures a relation between the concentration of the various gaseous phases which is given by the equation $RT \int L.dT/T^2 + N \log P + \log c_1^{n_1} \dots / C^m C_1^{m_1} \dots =$

constant where L is the heat of reaction, P the total pressure, c, c_1, \dots the concentration of the reaction gases, C, C_1, \dots that of the products, $n, n_1, \dots, m, m_1, \dots$ the numbers of the reacting and produced molecules, and N the sum $n + n_1 + \dots - m - m_1, \dots$. In the case of the system, carbon dioxide, carbon monoxide, and carbon, the final equilibrium does not depend on the initial state between 650° and 800° , and the expression reduces in this case to $-21000/T + \log c/C^2 = \text{constant}$, ($L = 42$ Cals.). From this, the ratios of the concentration of the two oxides at various temperatures are calculated, the agreement of result with experimental determinations being seen in the following table:

Temp.	Carbon dioxide.		Carbon monoxide.	
	Found.	Calc.	Found.	Calc.
650°	0.61	0.61	0.39	0.39
800	0.07	0.10	0.93	0.90
925	0.04	0.03	0.96	0.97

L. M. J.

Kinetics of Reactions with Auxiliary Reactions. By RUDOLF WEGSCHEIDER (*Zeit. physikal. Chem.*, 1899, 30, 593—600).—In the *Lehrbuch der Allgemeinen Chemie*, 2, ii, 247 *et seq.*, Ostwald considers the case of reaction, accompanied by collateral reactions, that is, a reaction in which two distinct sets of products result, but the cases examined are specially chosen as simplified examples, and in each lead to but one differential equation for the reaction velocity. The author considers the case more fully, and shows that in general there are as many differential equations needed as there are collateral reactions. The ratio of the sets of products is also in general a time function, but is constant in those cases in which the left sides of the equations representing the various reactions are identical, and the observation of this constancy is a sufficient proof of this identity obtaining.

L. M. J.

Velocities of Reaction. By ALEXANDRE DE HEMPTINNE (*Zeit. physikal. Chem.*, 1899, 31, 35—41).—Velocity constants are given for the hydrolysis of methyl acetate by mixtures of varying composition of hydrochloric acid and acetone, together with the electrical conductivities of the different mixtures. The velocity constant and the conductivity both decrease as the proportion of hydrochloric acid present decreases, but not to the same degree, the ratio of speed to conductivity increasing. Thus, besides the ionic action, the solvent exerts

further action on the velocity of hydrolysis, and, in the case of acetone this action is catalytic, since acetone has no action either on methyl acetate, or its products of hydrolysis.

In presence of glycerol, neither hydrochloric nor sulphuric acid gives constant velocity numbers for the hydrolysis of methyl acetate; the promotion of the hydrolysis by glycerol depends on the slight affinity the latter possesses for the acetic acid produced. T. H. P.

Velocity of Reaction in Heterogeneous Systems. By HEINRICH GOLDSCHMIDT [with ANTON MISSERSCHMITT] (*Zeit. physikal. Chem.*, 1899, 31, 235—249).—The difficulty of keeping a solution saturated with a slightly soluble substance in a heterogeneous system may be avoided by dissolving the substance in a liquid which does not mix with the solvent used; experience shows that in this case equilibrium is rapidly established between the two solutions.

The author has examined the rate of hydrolysis of ethyl acetate by dilute hydrochloric acid, dissolving the ester in benzene, and shaking the benzene solution with the hydrochloric acid solution. The equation for the velocity constant is $k = 1/t \cdot (v_2 + v_1 C) / v_1 C \log a / (a - x)$, where a is the initial quantity of ester, x the acetic acid formed after time t , v_1 and v_2 the volumes of hydrochloric acid and benzene respectively, and C ($= 0.079$) the partition coefficient of ethyl acetate between water and benzene. The values of k calculated with this equation are fairly constant, but show a tendency to fall with the time. This is accounted for by the action not going completely from left to right of the equation, a small quantity of the ester remaining undecomposed in the benzene. When allowance is made for this, a very satisfactory series of values is obtained for the constant.

A bimolecular reaction, the hydrolysis of ethyl acetate with baryta, has also been studied in a similar way. The velocity constant was found to have the same value as in a homogeneous system, provided the concentrations of the reacting substances were not over $1/20$ th normal. J. C. P.

The Velocity of Reaction before complete Equilibrium and before Transition Points. True meaning of the Law of Chemical Equilibrium of Heterogeneous Systems. Reactions in Heterogeneous Systems. By MEYER WILDERMANN (*Zeit. physikal. Chem.*, 1899, 30, 341—382).—See Proc., 1899, 15, 175.

Influence of Catalytic Agents on the Oxidation of Oxalic Acid Solutions. By W. P. JORISSEN and LODEWYK TH. REICHER (*Zeit. physikal. Chem.*, 1899, 31, 142—163).—The paper contains a full review of investigations hitherto published on the influence of catalytic agents on oxidation generally. Experiments made by the authors show that in diffuse light the oxidation of oxalic acid solutions is accelerated by the presence of iron, chromium, cerium, thorium, and erbium sulphates, sodium fluoride, and manganese sulphate, acetate, butyrate, benzoate, and oxalate. Potassium, magnesium, and yttrium sulphates have no accelerating influence. In sunlight, manganese sulphate, oxalate, acetate, butyrate, and benzoate increase the rate of oxidation. The extent of the acceleration depends on the nature of

the catalytic agent and grows with the concentration of the latter. The accelerated oxidation of oxalic acid, due to manganese salts, cannot be accounted for by the formation of manganese oxalate, which is much more slowly oxidised than oxalic acid itself. J. C. P.

Change in the Strength of Weak Acids by the Addition of Salts. By SVANTE ARRHENIUS (*Zeit. physikal. Chem.*, 1899, 31, 197—229).—When normal salts in small quantity are added to solutions of acetic, formic, and phosphoric acids, the inversion of sugar by these acids is accelerated; the amount of acceleration depends on the quantity of salt added, and is independent of the nature of the salt, although sodium bromide and potassium chlorate behave exceptionally. The observed acceleration is corrected (1) for the effect of the normal salt itself on the inversion, (2) for the formation by double decomposition of new undissociated electrolytes. Both corrections are small when the concentration of the salt solution added is small. After these two factors have been allowed for, it is seen that the addition of the normal salt increases the dissociation constant of the weak acid—exactly what happens in the case of an ordinary salt solution; further addition of salt, that is, increase of concentration, increases the dissociation constant, so that normal salts, strong acids, and bases do not obey Ostwald's dilution law.

The correction applied in conductivity experiments for the conductivity of the solvent water is probably too small, for the dissociation of the carbonic acid contained in the water would, in view of the above results, be much increased on the addition of salts. If this is so, the degree of dissociation of a salt, as hitherto calculated from the conductivity, is too small. The author points out that Noyes' method of calculating the conductivity of a mixed salt solution from that of the separate solutions leads to results at variance with observation; experiment, on the other hand, confirms the view that the conductivity of an electrolyte depends only on the total number of ions per litre (see Abstr., 1888, 1144). The author holds that Noyes' method of calculating the diminution of solubility of a salt on the addition of one of its ions to the saturated solution must be given up; experiments with the sodium and silver salts of fatty acids show that the undissociated portion of the sparingly soluble salt is by no means constant, as has hitherto been assumed. In these experiments, it was found that the first addition of the sodium salt had a much greater effect on the solubility of the silver salt than the later additions. J. C. P.

Nature of Soap Emulsions. By FREDERICK G. DONNAN (*Zeit. physikal. Chem.*, 1899, 31, 42—49).—When oil drops are allowed to ascend from a pipette through an alkaline liquid, the number of drops formed from a given volume of oil increases rapidly with the concentration of the alkali, owing to the diminution of surface tension caused by the formation of a soap. Commercial oils, which exhibit this phenomenon, have an acid reaction, and if the oil be first purified, the number of ascending drops is practically the same in N/1000 NaOH solution as in pure water. Solutions of fatty acids in a pure neutral hydrocarbon of the paraffin series behave similarly to

the commercial oils; the number of drops formed depends on the concentration of the acid as well as of the alkali, although the lower fatty acids are without action at all. The diminution of surface tension due to the salts of the higher fatty acids was confirmed by comparing the levels in a U-tube of two contiguous hydrocarbon and alkaline solutions.

The peculiar boiling phenomena of soap solutions, investigated by Krafft (Abstr., 1896, i, 80; ii, 468), cannot in the light of the above experiments be attributed to high surface tension, as has been done by Kahlenberg and Schreiner (Abstr., 1899, ii, 202), but is due to the frothing of the liquid, as shown by Lord Rayleigh.

It appears that the soap is concentrated in the layer between oil and aqueous solution, with the effect that the formation of small drops is favoured. The stability of an emulsion is due to this concentrated surface layer resisting the union of the already existing small drops; from this point of view, emulsions are akin to frothing, and it is suggested that froth is a sort of air emulsion. J. C. P.

Experiments on Adsorption. By JOHANNES G. C. VRIENS. (*Zeit. physikal. Chem.*, 1899, 31, 230—234).—When a centinormal solution of nitric acid is run through a number of filter papers successively, the concentration diminishes, and the fall of concentration, as determined by the change in conductivity, is proportional to the number of filters. J. C. P.

Inorganic Chemistry.

Distillation of Water. By W. MAREK (*J. pr. Chem.*, 1899, [ii], 60, 582—584).—The apparatus described is for the preparation of moderately large quantities of specially pure distilled water; it consists of a copper still of some 36 litres capacity internally tinned and fitted with a tin head and worm. The various parts are joined by flanges which are ground into one another, so that no organic or inorganic cementing material is required. Ordinary distilled water (30 litres) is introduced and is boiled for several minutes before the worm is cooled, 0.3 gram of potassium permanganate in concentrated aqueous solution is introduced, and the distillation carried out in the ordinary manner; the first 3 litres are rejected and the following 18 litres collected in large glass bottles previously treated with nitric acid. The flame employed is small, and the whole operation requires some 15 hours. J. J. S.

Nature of Water of Crystallisation. By FRIEDRICH RINNE (*Jahrb. f. Min.*, 1899, i, 1—31).—The water of crystallisation of a salt behaves in many ways like ordinary free water; for example, it gradually evaporates, especially at a slightly elevated temperature,

and in some salts there are certain points analogous to the boiling point of ordinary water. Copper sulphate ($\text{CuSO}_4 + 5\text{H}_2\text{O}$), when quickly heated, gradually rises in temperature to 105° , and remains at this temperature until $2\text{H}_2\text{O}$ has been expelled; the temperature then again gradually rises to 117° , when the boiling point of the second $2\text{H}_2\text{O}$ is reached; the boiling point of the last H_2O is 258° . A less sharply marked point is 99° , where $\frac{1}{2}\text{H}_2\text{O}$ is lost. For barium chloride ($\text{BaCl}_2 + 2\text{H}_2\text{O}$), the boiling point of each molecule of water is 105° and 162° . These boiling points vary with the atmospheric pressure.

Heulandite and stilbite are examples of another group of substances in which the water of crystallisation behaves in a different manner; here, there is nothing analogous to boiling point, the water being lost gradually and *pari passu* with the rise in temperature; at the same time, there is a gradual change in the optical orientation of the crystals (Abstr., 1896, ii, 368; 1897, ii, 327). The amount of water lost at any particular temperature is less the greater the atmospheric pressure and the greater the amount of moisture in the air.

In these two groups, the relation of the water of crystallisation to the salt can be considered to be, in the first case, that of a molecular compound, and, in the second, that of a solid solution. L. J. S.

Action of Persulphates on Iodine. BY HUGH MARSHALL (*Proc. Roy. Soc. Edin.*, 1898, 22, 388—390).—When solutions of potassium iodide and potassium persulphate are mixed and warmed, iodine is liberated; investigation shows that this iodine is oxidised to iodic acid by excess of persulphate. If iodine is digested in a loosely corked flask at a moderate temperature with a strong solution of ammonium persulphate, the iodine gradually dissolves, and crystalline ammonium hydrogen iodate is obtained. In Price's experiments on the reaction between potassium iodide and potassium persulphate (Abstr., 1899, ii, 147), there may have been catalytic action, the iodine being alternately oxidised by the persulphate, and reduced by hydriodic acid. J. C. P.

Vapour Density of Sulphur. By OTTO BLEIER and LEOPOLD KORN (*Ber.*, 1900, 33, 50—51. Compare Biltz, Abstr., 1888, 1027; 1889, 340; Biltz and Meyer, 1889, 674; Krause and Meyer, 1890, 1365; Riecke, 1891, 381; Schall, 1889, 331.—The following results have been obtained with the aid of the apparatus previously described (Abstr., 1899, ii, 643):

<i>t</i>	310°	262°	236°	212°	193°
<i>p</i>	42.6	15.0	9.4	4.2	2.1
$D(\text{O}_2 = 1)$	7.44	7.5	7.66	7.80	7.85

from which it follows that the undissociated sulphur molecule consists of eight atoms. J. J. S.

Hyposulphurous Acid. By AUGUST BERNTHSEN and MAX BAZLEN (*Ber.*, 1900, 33, 126—132. Compare Abstr., 1881, 508, 976).—By passing sulphur dioxide into a solution of sodium hydrogen sulphite in contact with zinc, it is converted quantitatively into the

hyposulphite according to the equation $2\text{NaHSO}_3 + \text{SO}_2 + \text{Zn} = (\text{Na}_2\text{S}_2\text{O}_4 + \text{ZnSO}_3) + \text{H}_2\text{O}$; by adding chalk, the zinc sulphite can be removed, and a solution of sp. gr. 15—16° Bé. obtained, which will reduce a fifth of its weight of indigo. From this solution, the sodium hyposulphite separates in crystals on adding salt or sodium hydroxide, and when washed with aqueous, and then with dry acetone, has the composition $\text{Na}_2\text{S}_2\text{O}_4 + 2\text{H}_2\text{O}$, thus confirming the authors' earlier conclusions, and disproving the formula NaHSO_3 given to the salt by Schützenberger [compare Nabl's zinc salt, ZnS_2O_4 (this vol., ii, 13)]; Grossmann's acid salts (*J. Soc. Chem. Ind.*, 1898, 17, 1109; 1899, 18, 452—453) cannot be prepared from the pure material, as sodium hyposulphite solutions deposit sulphur on adding a single drop of acid. Sodium hyposulphite forms large, thin, glistening prisms, which are fairly stable, but gradually effloresce and oxidise to sodium pyrosulphite, $\text{Na}_2\text{S}_2\text{O}_5$; the dry salt is more stable, but when heated to dull redness burns with a blue flame and liberates sulphur dioxide.

T. M. L.

Oxidation of Hydroxylamine. By GEORG VON KNORRE and KURT ARNDT (*Ber.*, 1900, 33, 30—42).—Either the acid hydroxylamine solution, or the oxidising solution, was boiled in a stout conical flask fitted with a funnel and a delivery tube until the air was expelled; the flask was then connected with a vessel filled with mercury, the second solution (freed from dissolved gas by boiling) was run in, and the gas evolved driven over by boiling into the vessel mentioned, transferred from this to a gas burette, and analysed. The oxidising agents tried were potassium nitrate and sulphuric or hydrochloric acid; hydrated manganese peroxide, potassium permanganate, potassium dichromate, vanadic acid, and potassium persulphate, all with sulphuric acid; alkaline copper sulphate and mercuric chloride; also hydrogen peroxide. Nitrous oxide is usually the main product, but nitric oxide is often mixed with it, and the solution nearly always contains nitric (or nitrous) acid. The relative amounts of the two oxides vary with the oxidising agent and with the concentration of the latter. With vanadic acid, the gas consists chiefly of nitrogen; with potassium persulphate, it is pure oxygen, and also with hydrogen peroxide, but in the last case only a small amount is formed.

C. F. B.

Action of very dilute Nitric Acid [on Metals]. By A. VAN BILJERT (*Zeit. physikal. Chem.*, 1899, 31, 103—113).—The products of the action of nitric acid on metals result from (1) the oxidising action of the non-dissociated portion of the acid, and (2) the reducing action brought about by the dissociated acid. The oxidising action is hence the greater the stronger the acid, and the reducing action is more evident when weaker acid is employed. For the metals magnesium, zinc, or cadmium the reaction, $2\text{M} + 2\text{HNO}_3, \text{Aq} = 2\text{MNO}_3, \text{Aq} + \text{H}_2$, is exothermic, and ammonium nitrate is among the products obtained; whilst, for copper, silver, or mercury, this decomposition absorbs heat, and in these cases no ammonium nitrate is found.

A series of experiments on the action of dilute nitric acid (N/20 to N/10) on zinc at about 25° shows that the amount of ammonia formed,

bears to the amount of zinc used, a ratio varying from 1 : 33 to 1 : 40, the ratio required by the equation $4\text{Zn} + 10\text{HNO}_3 = 4\text{Zn}(\text{NO}_3)_2 + \text{NH}_4\text{NO}_3 + 3\text{H}_2\text{O}$ being 1 : 15 or 16. This deviation is ascribed to the intermediate formation of the other reduction products, such as nitrous acid, nitric oxide, nitrogen, &c. No hydroxylamine was detected.

T. H. P.

Spontaneous Combustion of Coal. By RUD. GRIMM (*Zeit. angew. Chem.*, 1899, 1242).—A heap of slag containing furnace ashes mixed with a small proportion of unconsumed coal, became ignited internally on being left exposed to the air, probably owing to the presence in the interior of a small quantity of still glowing clinker; the outer crust of the heap was riven, and clouds of steam were evolved. In the rents so formed, large, rhombic crystals of sulphur and crusts of ammonium chloride were observed; the author explains the liberation of sulphur thus: $\text{FeS} + \text{H}_2\text{O} = \text{H}_2\text{S} + \text{FeO}$; $2\text{H}_2\text{S} + \text{SO}_2$ (from FeS_2) = $3\text{S} + 2\text{H}_2\text{O}$.

W. A. D.

Solubility of Argon and Helium in Water. By TADEUSZ ESTREICHER (*Zeit. physikal. Chem.*, 1899, 31, 176—187).—The absorption coefficient of argon is 0.05612 at 1°, and 0.02567 at 50°, falling regularly between those temperatures. The absorption coefficient of helium is 0.01487 at 0.5°, and 0.01404 at 50°, but at 25° it has a minimum value 0.01371; these values are about twice as large as that provisionally given by Ramsay, namely, 0.0073 at 18.2°. The minimum solubility of helium seems to be connected with the difficulty of liquefaction, for the solubility curve of hydrogen shows the same peculiarity (compare Abstr., 1892, 107); other gases with a higher critical temperature will probably be found to have a minimum solubility above 100°.

A full account is given of the apparatus and method employed.

J. C. P.

Electrolysis of Potassium Chloride. By ANDRÉ BROCHET (*Compt. rend.*, 1900, 130, 134—137).—A yield of over 70 per cent. of potassium chlorate is obtained when a neutral or slightly alkaline, 20 per cent. solution of potassium chloride, containing a small quantity of potassium dichromate is electrolysed with a current of 2 ampères, the temperature of the solution being maintained between 16° and 20°. If the solution is made more strongly alkaline, the yield of chlorate, and also of hypochlorite, is decreased, and if no potassium dichromate is present, the yield of potassium chlorate is never more than 35 per cent. (compare Foerster, *Zeit. Elektrochem.*, 1, 854).

H. R. LE S.

New Explosive and Detonating Materials. By UGO ALVISI (*Gazzetta*, 1899, 29, 478—490. Compare Abstr., 1899, ii, 414, 647, and 748).—The author gives the name *cremonites* to explosives composed of picric acid, or a picrate mixed with ammonium perchlorate. They keep well, require very powerful detonators, are more powerful than picric acid alone, and have a propulsive force nearly equal to that of the most powerful gelatin-dynamite.

Cannel powder is the name given to mixtures of coal and ammonium

perchlorate, 5 parts of the latter to 1 part of Scotch cannell giving the best results. It is simply prepared, has great resistance to shock, keeps well, is non-hygroscopic, and requires powerful detonators.

Ammonium perchlorate can be made on a commercial scale by the interaction of concentrated solutions of ammonium nitrate and sodium perchlorate. T. H. P.

Crystalline Hydrates of Sodium Thiosulphate. By W. W. TAYLOR (*Proc. Roy. Soc. Edin.*, 1898, 22, 248—251).—Crystals of the composition $\text{Na}_2\text{S}_2\text{O}_3 + 2\text{H}_2\text{O}$ may be obtained by driving off part of the water from the fused pentahydrate and allowing the solution to cool. The solubility curves of the pentahydrate and dihydrate intersect at 50° , which is accordingly the transition temperature of the two hydrates. To obtain the dihydrate in quantity, anhydrous thiosulphate is dissolved in fused pentahydrate and the solution kept at 53° . Crystallisation is induced by adding a few fragments of dihydrate, and the crystals formed are dried in an oven at 53° .

J. C. P.

Preparation of Metallic Lithium. By LOUIS KAHLENBERG (*J. Physical Chem.*, 1899, 3, 602—603).—Lithium may be obtained very readily by the electrolysis of solutions of lithium chloride in pyridine. A beaker with a concentrated solution of the salt in pyridine served as a cell, no diaphragm being used; a carbon pole was used as anode, and an iron plate as cathode; the E.M.F. was about 14 volts, the current density about 0.25 ampère per 100 sq. cm.; under these conditions, an adhering, silver-white deposit of metallic lithium was obtained. L. M. J.

Action of Magnesium on Saline Solutions. By HENRI MOURAOUR (*Compt. rend.*, 1900, 130, 140—141. Compare Abstr., 1899, ii, 656).—A rapid evolution of hydrogen takes place when magnesium powder is added to cold solutions of ammonium chloride, ammonium carbonate, ammonium oxalate, ammonium sulphide, sodium carbonate, borax, common alum, and chrome alum. With solutions of sodium phosphate, sodium acetate, sodium nitrite, sodium thiosulphate, potassium sodium tartrate, potassium chloride, potassium ferrocyanide, barium chloride, calcium chloride, and strontium chloride, the evolution of hydrogen is slow, and with a solution of ammonium fluoride, hydrogen is not evolved. H. R. LÉ S.

Metallic Borates. By LÉON OUVRARD (*Compt. rend.*, 1900, 130, 172—175).—The only well defined metallic salt of orthoboric acid is Ebelmen's magnesium borate, $\text{Mg}_3(\text{BO}_3)_2$ (*Ann. Chim. Phys.*, 1851, [iii], 33, 50). The evidence in support of the tribasic character of the acid is derived chiefly from the study of its esters.

Cadmium orthoborate, $\text{Cd}_3(\text{BO}_3)_2$, prepared by adding cadmium oxide (1 mol.) to a fused mixture of potassium hydrogen fluoride (1 mol.) and boric oxide (1 mol.), and treating the cooled product with water, separates in the form of prismatic needles not affected by water, but readily soluble in dilute acids. The crystals produce a

marked effect on polarised light, the plane of extinction being inclined at 9° to the principal axis. G. T. M.

Borates of Zinc, Manganese, Nickel, and Cobalt. By LÉON OUVREAU (*Compt. rend.*, 1900, 130, 335—338).—The compound, $3\text{ZnO} \cdot \text{B}_2\text{O}_3$, obtained by fusing zinc oxide with molecular proportions of potassium hydrogen fluoride and boric oxide, forms flat prisms which belong to the orthorhombic system and have a marked action on polarised light; they are decomposed by hot water and are readily soluble in dilute acids.

The following compounds were prepared in a similar manner: $3\text{MnO} \cdot \text{B}_2\text{O}_3$, from manganese chloride, carbonate, or precipitated borate, forms light-brown, transparent needles, which are not decomposed by hot water but are very soluble in dilute acids; $3\text{NiO} \cdot \text{B}_2\text{O}_3$, from nickel chloride, carbonate, or amorphous borate, forms short, clear, green prisms which are not attacked by hot water but are soluble in acids. In the case of cobalt, the borate obtained had the formula $2\text{CoO} \cdot \text{B}_2\text{O}_3$; if, however, less boric oxide is employed, then the compound $3\text{CoO} \cdot \text{B}_2\text{O}_3$ is obtained as rose-coloured, rhombic crystals.

H. R. LE S.

Behaviour of Zinc Oxide at High Temperatures. By ROBERT C. SCHÜPPHAUS (*J. Soc. Chem. Ind.*, 1899, 18, 987—989).—In heating a mixture of zinc oxide and carbon under pressure, a powder of a permanent canary-yellow hue was obtained; this when analysed shows a higher percentage of zinc than is contained in zinc oxide. Similar compounds may also be obtained by heating zinc oxide in a current of pure nitrogen, or in a vacuum, or with zinc dust under pressure. In each case, the product must be allowed to cool out of contact with the air.

L. DE K.

Hydrolysis of Thallic Sulphate. By HUGH MARSHALL (*Proc. Roy. Soc. Edin.*, 1899, 22, 596—597).—A slightly acid solution of thallic sulphate gives a brown precipitate of hydroxide on dilution; the same precipitate is formed when the solution is warmed, probably owing to an increase of hydrolysis with temperature; ammonium sulphate seems to prevent the formation of the precipitate on warming, but it redissolves in any case on cooling.

J. C. P.

New Micro-chemical Reactions of Copper. By Pozzi-Escot (*Compt. rend.*, 1900, 130, 90—91).—The iodide, $\text{CuI}_2 \cdot 4\text{NH}_3 \cdot \text{H}_2\text{O}$, is obtained in the form of small, blue tetrahedrons by adding ammonium iodide or sodium iodide to an ammoniacal solution of a cupric salt. An unstable compound, probably $\text{CuI}_2 \cdot 4\text{NH}_3$, is formed by adding ammonium iodide or sodium iodide to an ammoniacal solution of a cupric salt which is heated at 40° and contains sufficient ammonia to give a clear solution when hot. Under these conditions, the solution turns a yellowish-green colour, and deposits dark brown rhomboidal plates mixed with prismatic crystals of the same colour, and sometimes also with orange, orthorhombic plates. The colour and crystalline form of the deposit soon change, and after 10—40 minutes the deposit consists entirely of short, thick, flat prisms and triclinic

plates of a yellow colour and possessing a coppery lustre. When seen under the microscope, these changes are very characteristic.

H. R. LE S.

Action of Bromine on Copper Salts in Presence of Alkali Hydroxides. A New Test for Copper Salts. By DIOSCORIDE VITALI (*Chem. Centr.*, 1899, ii, 990—991; from *Boll. Chim. Farm.*, 38, 665—668).—When copper salts are treated with an alkali hydroxide in presence of an excess of bromine water, a brown to black precipitate of the peroxide CuO_2 is formed. Chlorine or iodine may be used instead of bromine, but the reaction then takes place much more slowly. The presence of 1/100000th part of copper in 1 c.c. of a solution of crystallised copper sulphate may be detected by the intense yellow coloration produced by evaporating the solution and treating the residue with potassium hydroxide solution and bromine water. By evaporating the solution to dryness, then adding a few drops of bromine water and again evaporating, a black residue of anhydrous copper bromide is left and by this method even 1/1000000th part of copper in 1 c.c. of a solution of the sulphate, may be detected. The black stain may be rendered more distinct by moistening the residue with concentrated sulphuric acid after evaporating with bromine water. By the action of alkali hydroxides and bromine on nickel and cobalt salts, the black hydroxides $\text{Ni}_2(\text{OH})_6$ and $\text{Co}_2(\text{OH})_6$ are formed. Platinum salts form the brown hydroxide $\text{PtO}_2(?)$. Manganese salts give a black and mercury salts a yellow precipitate. When bismuth oxide is treated with alkali and bromine water, the yellow hydroxide, $\text{Bi}(\text{OH})_3$, is first formed by the action of the alkali, and on heating is, by the action of the potassium hypobromite present, converted into a heavy brown powder of the oxide Bi_2O_3 . Lead salts behave in a similar manner, the yellow precipitate of lead oxybromide, which is first formed, being converted into the dioxide on heating; this oxide, unlike that of bismuth, is insoluble in a small quantity of dilute nitric acid. E. W. W.

Action of Ammonia on Diammoniomercuric Iodide. By MAURICE FRANÇOIS (*Compt. rend.*, 1900, 130, 332—335. Compare *Abstr.*, 1899, ii, 657).—When a solution of ammonia of sp. gr. 0.923 is added to mercuric iodide, white diammoniomercuric iodide is first formed. This, on the further addition of a large excess of ammonia, is converted into ammoniodimercuric iodide. The latter change is limited and also reversible, for on the addition of a solution of ammonia containing a large proportion of ammonium iodide to ammoniodimercuric iodide, the latter is partly converted into diammoniomercuric iodide.

H. R. LE S.

[Luminosity of Mixtures of Thoria and Ceria.] By HERMANN THIELE (*Ber.*, 1900, 33, 183—187).—The luminosity of mantles prepared from mixtures of thoria and ceria and heated in the Wehnelt arc (*Ann. Phys. Chem.*, 68, 260), is not appreciably changed by increasing the amount of ceria from 0—5 per cent., but with larger amounts the luminosity decreases owing to the increased resistance thereby caused.

In the flame of the Wehnelt arc, however, as with the Bunsen flame, the luminosity is a maximum with mixtures containing from 1—2 per cent. of ceria. W. A. D.

Separation of Gadolinite Earths and the Preparation of Pure Yttria. By WILHELM MUTHMANN and R. BÖHM (*Ber.*, 1900, 33, 42—49. Compare this vol., ii, 18).—The normal chromates of the rare earths are all more soluble than the corresponding sulphates. They have the general formula $M_2(\text{CrO}_4)_3 \cdot n\text{H}_2\text{O}$, and as a rule $n=8$. Separations of the rare earths may be more rapidly effected by the aid of these chromates than by any other known method, the separation being best accomplished by fractionally precipitating solutions of the readily soluble dichromates with potassium chromate. In the separation of yttria earths, it is essential that (1) both solutions must be extremely dilute; (2) the liquid must be kept in rapid ebullition during the precipitation; (3) the precipitate must be in an extremely finely divided state, and must be kept in intimate contact with the liquid. Minute directions are given in the original for securing these conditions. By employing this method, the authors have succeeded in obtaining pure yttria from commercial yttrium oxide after six fractionations, the last fraction consisting of pure yttrium chromate in the form of minute, deep red prisms.

The atomic weight of yttrium, determined from this fraction by conversion into sulphate and then igniting for 15—20 hours to convert into oxide, was found to be 88.97. Cleve (*Abstr.*, 1883, 292) gives 89.92.

The specific gravities of the earths from the six different fractions were found to be 6.06, 5.62, 5.43, 4.87, 4.83 (pure yttria), and that of the original mixture 5.62. Cleve and Höglund give 5.028, Nilson and Pettersson (*Compt. rend.*, 1880, 91, 232) give 5.06, and Ekeberg (*Phil. Mag.*, 14, 346) 4.842 for pure yttria.

The other constituents of the crude oxide are erbia, which yields olive-coloured octahedra with potassium chromate, and an earth which yields a chromate in the form of small, golden needles. J. J. S.

Gadolinium. By CARL BENEDICKS (*Zeit. anorg. Chem.*, 1900, 22, 393—421).—Gadolinium is separated from the other rare earths by crystallising the nitrates from nitric acid (*Abstr.*, 1896, ii, 475), and when a fairly pure nitrate is obtained, this is subjected to partial precipitation with dilute ammonia (*Abstr.*, 1891, 17). A determination of the atomic weight, by conversion of the oxide into sulphate, gave Gd = 156.38 (6 experiments: O = 16). The following compounds are described. Gadolinium oxide, Gd_2O_3 , is a white powder, easily soluble in acids, absorbs carbon dioxide from the air, is somewhat hygroscopic, and is not reduced by heating in a current of hydrogen. The *hydroxide* is a gelatinous precipitate, which rapidly absorbs carbon dioxide. The salts of gadolinium are mostly colourless, show no absorption spectrum, have a sweet, astringent taste, and are very similar to the salts of yttrium. The *chloride*, $\text{GdCl}_3 \cdot 6\text{H}_2\text{O}$, crystallises in thick, tabular, quadratic pyramids, and has a sp. gr. 2.424. The *bromide*, with $6\text{H}_2\text{O}$, crystallises in small,

pointed, rhombic tablets, of sp. gr. 2·844. The *platinichloride*, $\text{GdCl}_3 \cdot \text{PtCl}_4 + 10\text{H}_2\text{O}$, crystallises in orange-yellow, prismatic needles of sp. gr. 2·719. The *aurichloride* crystallises, with $10\text{H}_2\text{O}$, in yellow tablets of sp. gr. 2·706. *Gadolinium platinocyanide*, $2\text{Gd}(\text{CN})_3 \cdot 3\text{Pt}(\text{CN})_2 + 18\text{H}_2\text{O}$, obtained by the action of the sulphate on barium platinocyanide, crystallises in long, pointed, and tabular, red crystals of the rhombic system, having a green metallic lustre, and is isomorphous with the corresponding yttrium and erbium salts; sp. gr. 2·563. The *nitrate*, $\text{Gd}_3\text{NO}_3 + 6\frac{1}{2}\text{H}_2\text{O}$, separates over sulphuric acid, or by evaporation in the air, in large, triclinic crystals of sp. gr. 2·332. It also crystallises with $5\text{H}_2\text{O}$ from concentrated nitric acid in prisms of sp. gr. 2·406. The *double salt*, with ammonium nitrate, $\text{Gd}_3\text{NO}_3 \cdot 2\text{NH}_4\text{NO}_3$, crystallises in long, hair-like, deliquescent crystals. The *sulphate*, $\text{Gd}_2\text{SO}_4 + 8\text{H}_2\text{O}$, separates in small, lustrous, monoclinic crystals, and is isomorphous with yttrium sulphate; sp. gr. 3·007. The anhydrous salt has a sp. gr. 4·139. The double salt, with potassium sulphate, $\text{Gd}_2\text{SO}_4 \cdot \text{K}_2\text{SO}_4 + 2\text{H}_2\text{O}$, has a sp. gr. 3·503. 100 c.c. of a saturated potassium sulphate solution will hold 0·87—0·77 gram Gd_2O_3 in solution. The *selenate*, $\text{Gd}_2\text{SeO}_4 + 10\text{H}_2\text{O}$, crystallises at the ordinary temperature in large, colourless, rhombic prisms, is isomorphous with the yttrium and erbium selenates, and rapidly effloresces; sp. gr. 3·048. It separates, with $8\text{H}_2\text{O}$, at the temperature of the water-bath in nacreous crystals of sp. gr. 3·309. The anhydrous salt has a sp. gr. 4·175. The *double salt*, with potassium selenate, $\text{Gd}_2\text{SeO}_4 \cdot 3\text{K}_2\text{SeO}_4 + 4\text{H}_2\text{O}$, crystallises in slender, microscopic needles. *Gadolinium hydrogen selenite*, $\text{Gd}_2\text{SeO}_3 \cdot \text{H}_2\text{SeO}_3 + 6\text{H}_2\text{O}$, is an amorphous precipitate, which gradually forms aggregates of small needles. *Gadolinium ethyl sulphate*, $\text{Gd}_3\text{EtSO}_4 + 9\text{H}_2\text{O}$, obtained from the sulphate and barium ethyl sulphate, crystallises in large, transparent tablets belonging to the hexagonal system [$a:c=1:0\cdot5014$], is stable in the air, effloresces over sulphuric acid, and, when heated at 115° , loses $3\text{EtOH} + 6\text{H}_2\text{O}$; sp. gr. = 1·923. The *vanadate*, $\text{Gd}_2\text{O}_5\text{V}_2\text{O}_5 + 26\text{H}_2\text{O}$, crystallises in the triclinic system [$a:b:c=1\cdot7083:1:0\cdot9894$; $\alpha=84^\circ51'$, $\beta=94^\circ51'$, $\gamma=82^\circ13\cdot5'$]. The basic *carbonate*, $\text{OH}\cdot\text{GdCO}_3 + \text{H}_2\text{O}$, obtained by treating the hydroxide with carbon dioxide, crystallises in small, microscopic needles. The *normal carbonate*, $\text{Gd}_2\text{CO}_3 + 13\text{H}_2\text{O}$ (?), is obtained by prolonged action of carbon dioxide on the hydroxide. The *oxalate*, with $10\text{H}_2\text{O}$, crystallises from concentrated nitric acid in large, monoclinic crystals; 1 gram of ammonium oxalate dissolved in 38 grams of water will hold 0·00083 gram of gadolinium oxide in solution. The *acetate* crystallises with $4\text{H}_2\text{O}$ in sparingly soluble, colourless, triclinic crystals of sp. gr. 1·611. The *propionate* crystallises in a vacuum desiccator in crusts of large, rhombic tufts. E. C. R.

Stable Hydrates of Manganese Chloride above 0° . By HARRY M. DAWSON and P. WILLIAMS (*Zeit. physikal. Chem.*, 1899, 31, 59—68).—Investigation with the dilatometer shows that the ordinary hydrate of manganese chloride, $\text{MnCl}_2 + 4\text{H}_2\text{O}$, is transformed into the dihydrate at $57\cdot9^\circ$, at which temperature also the vapour tension of the dry tetrahydrate becomes equal to the vapour pressure of the saturated

solution; at the same temperature, there is a corresponding discontinuity in the solubility curve and in the density of the saturated solution. When a manganese chloride solution crystallises at about 70° , large, well-formed crystals are obtained which, after draining, washing with alcohol, and drying between filter paper, are found to have the composition $\text{MnCl}_2 + 2 \cdot 2\text{H}_2\text{O}$, confirming the dilatometer result. A better method of preparing the dihydrate is to pass hydrogen chloride into an alcoholic solution of manganese chloride saturated at the ordinary temperature; the crystals of the dihydrate which separate are pink, but deeper in tint than the ordinary tetrahydrate. The dihydrate is stable from 58 — 198° ; at the latter temperature, it is transformed into the anhydrous salt.

Marignac's β -tetrahydrate, obtained by crystallisation at 0 — 6° of a solution saturated at a higher temperature, represents a labile form at all temperatures. J. C. P.

Peroxides. By SIMEON M. TANATAR (*Ber.*, 1900, 33, 205—208).—Peroxides are usually divided into two classes, the members of one of which yield hydrogen peroxide on treatment with acids, whilst those of the other do not. Piccini (*Abstr.*, 1897, ii, 9) further states that the true (hydrogen peroxide yielding) peroxides reduce certain compounds, such as manganese dioxide, lead dioxide, and potassium permanganate, in presence of acids, and that they are never produced by oxidation carried out with nitric or hypochlorous acid.

The author suggests that the two classes of peroxides may not differ in chemical constitution, but that the differences between their reactions may be accounted for by thermochemical considerations. The heat developed by the action of acids on the "false" peroxides is less than that required for the formation of hydrogen peroxide. Nickel peroxide, which acts in most respects as a false peroxide, develops, however, sufficient heat to render possible the formation of hydrogen peroxide, and the author has found that perceptible amounts of hydrogen peroxide are actually produced by the decomposition of nickel peroxide with sulphuric acid. The peroxides of nickel and cobalt, moreover, appear capable of converting barium hydroxide into the peroxide, for in their presence barium hydroxide brings about the reduction of potassium permanganate. Potassium permanganate is also slowly decolorised in the cold when it is mixed with solutions of sodium hypochlorite and barium hydroxide. A. H.

Nature of the Change from Violet to Green in Solutions of Chromium Salts. By WILLIS R. WHITNEY (*J. Amer. Chem. Soc.*, 1899, 21, 1075—1084. Compare *Abstr.*, 1896, ii, 525).—The author considers that the conclusions of Venable and Miller (*Abstr.*, 1898, ii, 592) are erroneous, and describes experiments which confirm the observations of Recoura (*Abstr.*, 1896, ii, 27) and of Favre and Valson (*Compt. rend.*, 1872, 74, 1032). [Compare also Dougal (*Trans.*, 1896, 69, 1526).] E. G.

A New Crystalline Molybdenum Sulphide. By MARCEL GUICHARD (*Compt. rend.*, 1900, 130, 137—140).—When molybdenum disulphide is heated in the electric furnace, it is decomposed, and a

new compound, *molybdenum sesquisulphide*, Mo_2S_3 , is formed; this crystallises in steel-grey needles of sp. gr. 5.9 at 15° . When slightly heated, it is readily decomposed by fluorine and chlorine, but only at a red heat by bromine, whilst iodine is without action on it, even at the higher temperature. When strongly heated in oxygen, molybdenum trioxide is formed, and in atmosphere of sulphur, it is converted into the disulphide. Hydrochloric and sulphuric acids have no action on it, but hot concentrated nitric acid and aqua regia readily dissolve it with formation of molybdic and sulphuric acids. If molybdenum sesquisulphide is heated to a temperature slightly higher than that at which it is formed, it is decomposed into metallic molybdenum, and, if carbon is present, the carbide CMo_2 is formed.

H. R. LE S.

Enantiotropy of Tin. II. By ERNST COHEN and C. VAN ELJK (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 149—153; *Zeit. physikal. Chem.*, 1899, 30, 601—622. Compare this vol., ii, 83).—The velocity of change of the white into the grey modification of tin has been determined, with the aid of a dilatometer, at various temperatures from 0° to -83° , and has a maximum at about -48° , which is accordingly the most favourable temperature for the conversion of white tin into grey tin.

Further qualitative investigation at a temperature of -4° to -7° shows that the change of dry white tin into grey tin takes place slowly, beginning at the edges. If the white tin has powdered grey tin in contact with it, the change is accelerated, and begins at the points of contact. White tin filings are much more rapidly converted than white block tin.

J. O. P.

Enantiotropy of Tin. III. By ERNST COHEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 281—286. Compare preceding abstract).—White tin can be inoculated with grey tin; a large block treated thus and kept at -5° for 3 weeks was photographed and seen to be covered with grey nodules.

Previous investigation has shown that the velocity of change of white tin into grey tin is a maximum at -40° , and zero at 20° . At the ordinary temperature, the velocity is small, and a very long time would be necessary for the transformation. This condition was regarded as fulfilled in the case of an antique vase dug up in Hampshire, and supposed to date from the fourth century; on examination, the vase was found to consist almost entirely of grey tin.

The velocity of the change of grey tin to white tin above 20° has been investigated with the aid of a dilatometer, and found to increase very rapidly, rendering measurement impossible at 40° .

J. C. P.

Bismuth Suboxide and Subsulphide. By R. SCHNEIDER (*J. pr. Chem.*, 1899, [ii], 60, 524—543. Compare Abstr., 1899, ii, 227).—The following method for the preparation of bismuth suboxide, Bi_2O_3 , is simpler, and yields better results, than the two methods previously described by the author. A solution of bismuth oxide, Bi_2O_3 , in nitric acid, is poured slowly and with constant stirring into excess of dilute potassium hydroxide; the precipitate of bismuth hydroxide is washed by decantation, and then suspended in 2 per cent. potassium hydroxide in a

capacious flask; a solution of freshly prepared stannous chloride is slowly added, the flask completely filled with air-free water, tightly closed, and the contents well shaken. Bismuth suboxide is thus obtained as a light, perfectly homogeneous, black powder. If freely exposed to the air in a moist state, it is completely converted into ordinary bismuth hydroxide.

Bismuth subsulphide, Bi_2S_3 , is conveniently prepared by heating bismuth suboxide in a stream of dry hydrogen sulphide. It forms a slate-grey, dense, entirely homogeneous powder. When moderately heated in absence of air, it remains unchanged; at a low red heat, it melts and decomposes into bismuth and the ordinary bismuth sulphide. If heated in a current of hydrogen, it is reduced to the metal; the reduction begins at the temperature of melting sulphur, and then proceeds smoothly and rapidly.

The author replies in detail to the criticisms of Vanino and Treubert (*Abstr.*, 1899, ii, 428) on his previous communications, and adheres to his former conclusions. E. G.

Isomorphous Compounds of Gold and Mercury. By THEODOR H. BEHRENS (*Proc. K. Akad. Wetensch. Amsterdam*, 1899, 2, 163).—The halogen salts of these metals have been found to yield complete series of compound crystals. These were prepared by adding chlorides or bromides of thallium, caesium, and rubidium to mixed solutions of the chlorides and bromides of gold and mercury. J. C. P.

Preparation of Colloidal Metallic Solutions by the Disintegrating Action of an Electric Discharge. By GEORG BREDIG (*Zeit. angew. Chem.*, 1898, 951–954).—Hitherto colloidal metallic solutions have been obtained by the action of chemical reducing agents. The author describes how an electric discharge between poles of gold, silver, and platinum, immersed in water, disintegrates the cathode, and gives a solution of the metal. In the case of gold, reddish-purple or dark blue solutions are thus obtained, which can be filtered without change and keep their colour for months; the gold may be precipitated from the solution by freezing or by the addition of electrolytes; non-electrolytes, on the other hand, are ineffective. When the colloidal solution is subjected to electrolysis, the metal is separated at the anode as a black slime.

Silver and platinum give clear, dark brown solutions, which even with a small metal concentration absorb light almost entirely and are generally similar in properties to the colloidal gold solution. The colloidal platinum solution behaves like platinum black in decomposing hydrogen peroxide with evolution of oxygen.

Careful microscopic investigation reveals no heterogeneity, but the author is nevertheless of opinion that these solutions are really heterogeneous systems of the very finest structure, the particles having probably about a thousand times the molecular dimensions. The colours observed are regarded as due to this state of fine division. J. C. P.

Inorganic Ferments. I. Catalytic Action of Platinum, and the Chemical Dynamics of Hydrogen Peroxide. By GEORG BREDIG and R. MÜLLER VON BERNECK (*Zeit. Physikal. Chem.*, 1899, 31, 258–353).—Close analogy exists between the decomposition of

hydrogen peroxide by organic ferments (Jacobson, *Abstr.*, 1892, 899), and by colloidal platinum. The latter agent is formed by the action of an electric discharge between platinum wires immersed in water, and the dark brown solution so obtained (with a maximum possible concentration of 1 gram-atom of platinum in 1300 litres of water) behaves in numerous cases exactly like platinum black. As this colloidal platinum is precipitated by electrolytes, its action is advantageously studied on hydrogen peroxide, which is practically a non-conductor, and yields non-electrolytic decomposition products.

Solutions of hydrogen peroxide were prepared with the conductivity 1.5×10^{-5} — 3.7×10^{-5} ; to a suitably diluted portion, some of the platinum solution was added, and the mixture was kept at a constant temperature (generally 25°); portions extracted from time to time were titrated with permanganate solution, and the progress of the decomposition of hydrogen peroxide thus determined. Even a solution of 1 gram-atom of platinum in about 70 million litres of water markedly accelerates the decomposition of hydrogen peroxide. The authors have compared with this the catalytic action of the peroxides of manganese, cobalt, copper, and lead, in both acid and alkaline solution.

The decomposition of hydrogen peroxide in acid and neutral solution in presence of colloidal platinum of constant quantity and condition, proceeds strictly according to the unimolecular equation, $2\text{H}_2\text{O}_2 = 2\text{H}_2\text{O} + \text{O}_2$. In alkaline solution, the catalytic action of colloidal platinum first increases, reaches a maximum, and then diminishes again, as the alkali concentration increases; this is exactly what happens in the action of organic ferments on hydrogen peroxide. The values for the velocity constant obtained in alkaline solution are not steady, probably owing to the partial combination of the hydrogen peroxide and the alkali, as indicated by freezing point and other experiments.

Colloidal platinum and organic ferments are both alike affected by the addition of electrolytes, but the analogy is perhaps most strikingly illustrated by the effect of certain poisons, such as hydrocyanic acid, hydrogen sulphide, and mercuric chloride; the colloidal platinum is, as it were, paralysed by these agents, but recovers itself after a certain time.

The catalytic action of the colloidal platinum solution increases with its concentration, although not proportionally, and is favoured by rise of temperature; the increase of the velocity constant in the latter case agrees well with Arrhenius' equation $\log k_1/k_2 = A(T_1 - T_2)/(T_1 \cdot T_2)$, where k_1 and k_2 are the velocity constants corresponding to the temperatures T_1 and T_2 , and A is a constant (*Abstr.*, 1889, 1103). Light does not affect the catalytic action of the colloidal platinum.

The view that platinum acts on hydrogen peroxide as certain solids do on supersaturated gas solutions is not confirmed. The paper contains a review of various theories of catalytic action. J. C. P.

Platinum Tetrachloride. By ARTURO MIOLATI (*Zeit. anorg. Chem.*, 1900, 22, 445—465).—The electric conductivity of aqueous solutions of platinum tetrachloride is not constant, but alters with the

time, and the values are dependent on the dilution; the results are essentially those given by a weak acid, and are similar to those obtained with selenious acid. An aqueous solution of platinum tetrachloride, when titrated with sodium hydroxide, using phenolphthalein as indicator, is neutralised with two equivalents of alkali; and by determining the specific conductivity of solutions to which successive quantities of alkali are added, unmistakable evidence of the formation of an acid and a normal salt is obtained. This is more clearly shown when ammonia is used to neutralise the solution. It is therefore evident that a solution of platinum tetrachloride contains a dibasic acid. The silver salt, $\text{Ag}_2\text{PtCl}_4(\text{OH})_2$, has been known for some time. The author was unable to isolate the alkali salts from their solution. Copper, zinc, or cadmium hydroxides dissolve in the aqueous solution, but the resulting salts do not crystallise, and yellowish-brown gums are obtained, easily soluble in water and alcohol. The alcoholic solution, when precipitated with ether, yields yellow, gummy flocks, which solidify after a time, and these, on analysis, gave numbers agreeing fairly well with the formulæ $\text{ZnPtCl}_4(\text{OH})_2 + 3\text{H}_2\text{O}$ and $\text{CdPtCl}_4(\text{OH})_2$. The *thallium* salt, $\text{Tl}_2\text{Pt}_2\text{Cl}_8\text{H}_6\text{O}_4$, obtained by precipitating an aqueous solution of the tetrachloride with a thallium salt, is a yellow, amorphous powder. The *lead* salt, $\text{PbPtCl}_4(\text{OH})_2$, is obtained as a yellow precipitate by adding a mixture of lead and sodium acetates to the aqueous solution; the *lead* salt, $\text{PbPtCl}_4(\text{OH})_2 \cdot \text{Pb}(\text{OH})_2$, obtained in alcoholic solutions, is a brownish powder. E. C. R.

Nature of Palladium Hydrogen. By JOHN SHIELDS (*Proc. Roy. Soc. Edin.*, 1898, 22, 169—186).—The E.M.F. of the combination—palladium containing a small quantity of hydrogen | dilute sulphuric acid | palladium containing a large quantity of hydrogen—is zero, or nearly so. Thus the cell does not behave like a true concentration cell, as would probably be the case were the absorption of hydrogen by palladium simply a process of solution. The view that a chemical compound is formed would agree better with the facts, for the E.M.F. in this case would be independent of the quantity of compound formed. The experiments are insufficient to determine whether the compound formed is Pd_3H_2 , or whether it contains more hydrogen than corresponds with this formula. J. C. P.

Mineralogical Chemistry.

Accumulation of Iron in Peat. By JACOBUS M. VAN BENMELLEN [with C. HOITSEMA and EDUARD A. KLOBBIE] (*Zeit. anorg. Chem.*, 1899, 22, 313—379).—This paper covers, but in greater detail, much the same ground as one already noticed (*Abstr.*, 1899, ii, 371). Several more analyses of impure chalybite, iron ochre and vivianite are given. L. J. S.

Formation of Petroleum. By CARL ENGLER (*Ber.*, 1900, 33, 7—21).—Krämer and Spilker's arguments (this vol., i, 73) are inconclusive, and their experiments were hardly needed, for the author had shown already that all fats and waxes, whether of animal or vegetable origin, yield petroleum when distilled under pressure. He explains at some length his view of the mode of formation of petroleum. This was, he thinks, formed in the main by the decomposition of animal deposits of marine origin; the nitrogenous matter in this decomposed comparatively rapidly, leaving a wax almost free from nitrogen; this became buried under subsequent deposits, and was in consequence subjected to greater pressure and a higher temperature, under the influence of which it yielded petroleum. C. F. B.

Graftonite, a new Mineral. By SAMUEL L. PENFIELD (*Amer. J. Sci.*, 1900, [iv], 9, 20—32).—The new mineral is found associated with beryl, tourmaline, &c. in pegmatite on Melvin Mountain, near Grafton, New Hampshire. The fragments and indistinct crystals have a rough, weathered appearance, and are striking in being built up of thin, alternately light and dark lamellæ, the light material being graftonite and the dark oxidised triphylite; in a fresh specimen, the two minerals are salmon-coloured and pale green respectively. The graftonite has a vitreous to resinous lustre and closely resembles salmon-coloured lithiophilite in appearance. Analyses of the separated minerals are given under I (grafftonite, sp. gr. 3·672) and II (triphylite, $\text{Li}(\text{Fe}, \text{Mn})\text{PO}_4$, sp. gr. 3·58); analysis III, by W. E. Ford, was made on partly oxidised graftonite imperfectly separated from triphylite. Details of the method of analysis are given.

	P_2O_5	FeO	MnO	Fe_2O_3	CaO	MgO	K_2O	Na_2O	Li_2O	H_2O	Total
I. 41·20	30·65	17·62	—	9·23	0·40	—	—	—	0·33	0·75	100·18
II. 42·3	33·4	9·9	—	0·2	1·3	—	—	—	9·2	1·7	98·0
III. 40·80	24·28	15·38	10·16	7·25	—	0·14	1·15	—	1·17	100·33	

These analyses (in III calculating the whole of the iron as ferrous) give the formula for graftonite as $(\text{Fe}, \text{Mn}, \text{Ca})_3\text{P}_2\text{O}_8$ or $\text{R}''_3\text{P}_2\text{O}_8$. Few other anhydrous, normal phosphates are known amongst minerals. Crystals of graftonite are monoclinic with approximately $a:b:c = 0·886:1:0·582$; $\beta = 66^\circ$. The peculiar intergrowth of the monoclinic graftonite and the orthorhombic triphylite is discussed in detail; there appears to be a definite crystallographic relation between the two minerals. Similar cases are the intergrowth of albite and orthoclase, rutile and hæmatite. L. J. S.

Anhydrite and Gypsum Deposits at Oulx, Piedmont. By LUIGI COLOMBA (*Jahrb. f. Min.*, 1900, i, Ref. 26—28; from *Atti Accad. Sci. Torino*, 1898, 33, 779—796).—The deposits of gypsum and anhydrite near Oulx, in an upper valley of the Dora Riparia, occur with beds of limestone, sometimes dolomitic, from which, it is suggested, the calcium sulphate has been derived by the action of volcanic gases. A description is given of each of the following minerals which occur in both the limestone and the gypsum: mica, tourmaline, quartz, chalcedony, pyrites, sulphur, dolomite, halite, hæmatite and blende.

The optically uniaxial mica occurs as minute scales, and is shown

by the following analysis to be a biotite containing lithium; it differs from ordinary lithia mica in containing much magnesia.

SiO ₂ .	Al ₂ O ₃ .	MgO.	CaO.	Li ₂ O.	Na ₂ O, (K ₂ O).	Loss on ignition (H ₂ O, F).	Total.
42.40	12.66	20.10	6.76	5.21	4.68	6.82	98.63

Analysis of the dolomite gave MgCO₃, 42.75; CaCO₃, 57.21 = 99.96.

L. J. S.

[Celestite from Baltschiederthal, Switzerland.] By CARL SCHMIDT (*Jahrb. f. Min.*, 1900, i, 16—21).—The fissured masses of Triassic dolomitic limestone folded in the gneisses of the Baltschiederthal, Wallis, contain in the crevices, crystals of dolomite, celestite, fluor, calcite, quartz, barytes, adularia, anatase, blende, &c. A description is given of each of these minerals. Bluish crystals of celestite gave the following results on analysis by M. Scheid:

SrO.	BaO.	CaO.	SO ₂ .	SiO ₂ .	Al ₂ O ₃ .	Fe ₂ O ₃ .
54.29	0.25	0.17	42.72		traces	

L. J. S.

[Mineral Analyses.] By KARL BUSZ (*Jahrb. f. Min.*, 1899, *Beil. Bd.*, 13, 90—139).—In a petrological paper describing the granite and contact rocks of the Dartmoor Forest, Devonshire, the following analyses are given of minerals from the metamorphosed Devonian limestone at South Brent.

Garnet occurs abundantly, in one case as a vein two metres wide; the brownish-green, rhombic dodecahedra and granular masses show marked optical anomalies; Analysis I (contains also traces of manganese, magnesium and sodium) shows the mineral to be andradite with the formula $9(\text{Ca}_2\text{Fe}_2\text{Si}_3\text{O}_{12}) + \text{Ca}_2\text{Al}_2\text{Si}_2\text{O}_{12}$.

Datolite occurs as a white, saccharoidal mass in which the garnets are embedded; anal. II (B₂O₃ by difference 21.65; also a trace of sodium). This is a very unusual mode of occurrence of datolite.

Augite occurs in large, grey-green masses which are fibrous or compact: Analysis III shows it to be hedenbergite; the ferric oxide is due to oxidation, as the mineral is not quite fresh.

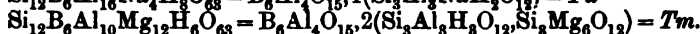
	SiO ₂ .	Al ₂ O ₃ .	Fe ₂ O ₃ .	FeO.	MnO.	CaO.	MgO.	K ₂ O.	H ₂ O.	Total.	Sp. gr
I.	37.17	2.80	26.93	Nil	—	32.34	—	0.58	0.65	100.47	3.65
II.	36.10	1.68		—	—	34.55	—	trace	6.02	—	2.76
III.	49.29	0.29	4.92	16.70	0.86	22.55	5.49	—	—	100.10	—

Other secondary minerals present in the limestone are axinite and quartz.

L. J. S.

Theory of Tourmaline Mixtures. By GUSTAV TSCHERMAK (*Tsch. Min. Mitth.*, 1899, 19, 155—164. Compare Abstr., 1899, ii, 304, 601, 767).—From a consideration of Riggs's analyses (Abstr., 1888, 659), Wülfing showed (Abstr., 1889, 765) that tourmalines may be considered to be isomorphous mixtures of the two silicates, Si₁₂B₆Al₁₆Na₄H₃O₆₃ and Si₁₂B₆Al₁₀Mg₁₂H₃O₆₃, in which aluminium may

be replaced by iron, and magnesium by iron, calcium, &c. Each of these may be written partly as a borate and partly as a silicate :



These formulae, the silicate portions of which represent paragonite and merzoxene respectively, express the relations existing between the micas and tourmalines as shown by their modes of origin, occurrence, alteration, &c. The relation is similar to that shown by the author to exist between the plagioclase and scapolite groups. Most tourmaline analyses can be explained by mixtures of the above molecules ; for example, Penfield and Foote's recent analyses (Abstr., 1899, ii, 304) give $\text{Tu}_{44}\text{Tr}_7$ (Haddam Neck), and $\text{Tu}_{13}\text{Tr}_{37}$ (De Kalb). A few analyses are explained by the presence of a third molecule :

$\text{Si}_{12}\text{B}_6\text{Al}_8\text{Mg}_{12}\text{H}_8\text{O}_{61} = \text{B}_6\text{Al}_4\text{O}_{15}, 2(\text{Si}_3\text{Al}_3\text{H}_3\text{O}_{12}), \text{Si}_3\text{Mg}_6\text{O}_{12} = \text{Tr.}$, of which the silicate portion has the phlogopite formula. L. J. S.

Kelyphite. By JOSEF MRHA (*Tsch. Min. Mitth.*, 1899, 19, 111—143).—A microscopical examination of the fibrous shells of kelyphite surrounding garnets in serpentine shows the material to consist of a mixture of augite, spinel, bronzite and hornblende. The composition of the kelyphite from near Steinegg, Austria, is given under I, and the spinel (picotite), isolated from it, gave II. The garnet (pyrope) gave III. The alteration of olivine and pyrope to augite and spinel is accompanied by an increase in molecular volume.

	SiO ₂	Al ₂ O ₃	Cr ₂ O ₃	Fe ₂ O ₃	FeO	MnO	CaO	MgO	Loss on ignition.	Total.	Sp. gr.
I.	41.12	15.38	2.63	4.18	4.01	0.39	4.73	25.54	0.92	98.90	—
II.	—	51.34	12.40	6.88	9.36	—	—	19.88	—	99.86	3.726
III.	42.29	21.12	2.86	8.11	—	0.36	5.42	19.90	—	100.06	3.697

L. J. S.

[Allophane from Italy.] By GIOVANNI D'ACHIARDI (*Jahrb. f. Min.*, 1900, i, Ref. 16, 29 ; from *Proc. Verb. Soc. Toscana Sci. Nat.*, 1898, 12, 26—39).—Sky-blue to grey-blue, optically isotropic allophane fills crevices and forms reniform crusts in zinc ores at Valdaspra, Massa Maritima, Tuscany, where it is associated with linarite, aurichalcite (Abstr., 1898, ii, 604), &c. After deducting zinc, copper and calcium as hemimorphite, chrysocolla and calcite, analysis I. gives the formula $\text{Al}_2(\text{OH})_2\text{SiO}_4 + 5\text{H}_2\text{O}$.

Allophane from Rosas, Sulcis, Sardinia, gave II (also contains Cr_2O_3 , trace) from which, after deducting excess of silica as hyalite, the formula is deduced as $\text{Al}_2(\text{OH})_2\text{SiO}_4 + 4\text{H}_2\text{O}$.

	SiO ₂	Al ₂ O ₃	ZnO	CuO	CaO	(below 350°). H ₂ O.	H ₂ O, ignition.	Total.	Sp. gr.
I.	24.00	32.01	1.44	1.21	0.66	32.90	6.49	98.72	1.93
II.	30.39	32.63	1.63	1.18	0.23	27.18	5.88	99.12	2.00—2.086

Cupriferrous allophane is also described from a copper mine at Cascine, Mezzanago ; it contains no zinc and only a trace of calcium.

L. J. S.

New Occurrence of Laumontite. By OTTO LUEDECKE (*Zeit. f. Naturwiss.*, 1899, 72, 101—104).—The quartz-porphyry on Peters-

berg, near Halle, contains embedded laumontite, associated with secondary fluorite, calcite, epidote and quartz. The laumontite has been apparently derived from oligoclase; it is reddish-yellow, and without crystal faces. The mean of two analyses is, after deducting a little calcite,

SiO ₂	Al ₂ O ₃	CaO.	H ₂ O.	Total.
50.66	22.26	13.60	13.56	100.09

L. J. S.

Action of Ammonium Chloride on Analcite and Leucite.

By FRANK W. CLARKE and GEORGE STEIGER (*Amer. J. Sci.*, 1900, [iv], 9, 117—124; and *Zeit. anorg. Chem.*, 1900, 23, 135—145).—In a previous paper (this vol., ii, 25), it was shown that analcite, when heated at 350° in an open crucible with ammonium chloride, gave up part of its soda and absorbed some ammonia; at a higher temperature, ammonia is again liberated. Further experiments have now been made on analcite from North Table Mountain, near Golden, Colorado, the composition of which is given under I. When the material is heated at 350° in a sealed tube with ammonium chloride, the whole of the soda is converted into sodium chloride, and all the liberated ammonia absorbed by the silicate; the residue has the composition $\text{NH}_4\text{AlSi}_2\text{O}_6$, and appears to be the first ammonium silicate that has been prepared. In the presence of excess of free ammonia there is no further absorption of ammonia. On boiling this ammonium compound with caustic soda solution, the whole of the ammonia is expelled and sodium again taken up. The product previously obtained with analcite is now to be regarded as a mixture.

Leucite (from Vesuvius, anal. II.), when heated in a sealed tube with ammonium chloride, yields the same compound, $\text{NH}_4\text{AlSi}_2\text{O}_6$, as does analcite. When this ammonium leucite, the composition of which is given under III, is fused with calcium chloride, a product approximating in composition to the corresponding calcium salt, $\text{CaAl}_2\text{Si}_4\text{O}_{13}$, is obtained. This ammonium leucite is not a metasilicate, as shown by the fact that no soluble silica is liberated when the material is ignited.

	SiO ₂	Al ₂ O ₃	CaO.	K ₂ O.	Na ₂ O.	H ₂ O.	NH ₃ .	Total.
I.	55.72	23.06	0.17	—	12.46	8.39	—	99.80
II.	55.40	23.69	0.16	19.54	1.25	0.24	—	100.28
III.	60.63	26.44	trace	0.50	0.25	5.17	7.35	100.34

Preliminary experiments show that several other zeolites behave in a similar manner when heated with ammonium chloride.

L. J. S.

Granitoid Rocks from Cape Marsa. By LOUIS DUPARC and F. PEARSON (*Compt. rend.*, 1900, 130, 432—434).—Petrographical descriptions, with analyses, are given of granulite, tonalite and microtonalite.

L. J. S.

Eruptive Rocks from the Salekammergut. By CONRAD H. VON JOHN (*Jahrb. k.k. geol. Reichs. Wien*, 1899, 49, 247—258).—Quartz-diorite (= tonalite) from the Pöllagraben, St. Gilgen, consisting of plagioclase, hornblende and biotite with some orthoclase and

quartz, gave analysis I; the large crystals of white felspar (andesine) isolated from the rock gave II.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	K ₂ O	Na ₂ O	P ₂ O ₅	Loss on ignition	Total.
I.	58.20	0.21	19.20	2.01	4.42	5.60	3.25	1.81	4.53	0.38	1.28	100.84
II.	58.97	—	25.21	0.65	—	6.82	0.21	0.71	6.02	—	0.50	99.09

Analyses of several other rocks are given.

L. J. S.

Analyses of Italian Volcanic Rocks. II. By HENRY S. WASHINGTON (*Amer. J. Sci.*, 1900, [iv], 9, 44—54. Compare this vol., ii, 27).—Six analyses are given of various volcanic rocks from Tuscany and Rome.

L. J. S.

Plagioliparites of Cape Marsa, Algeria. By LOUIS DUPARC and F. PEARCE (*Compt. rend.*, 1900, 130, 56—58).—The plagioliparites of Cape Marsa, in Algeria, consist of plagioclase, biotite and quartz in a matrix which may be vitreous, globular, felsitic or perlitic with large spheruliths, but in all cases the composition is practically the same: SiO₂, 72.74—77.99; Al₂O₃, 12.46—12.70; Fe₂O₃, 1.06—1.91; CaO, 1.21—1.59; MgO, 0.05—0.15; K₂O, 4.10—5.71; Na₂O, 2.85—3.60; loss on heating, 0.24—2.92 per cent.

C. H. B.

Meteorites from Jamyscheff and Tubil River, Siberia. By J. A. ANTIPOFF (*Chem. Centr.*, 1899, i, 801; from *Bull. Acad. St. Pétersbourg*, 1898, [v], 9, 91—103).—Analysis I is of the metallic portion of the meteorite which fell in the neighbourhood of the village of Jamyscheff, Pawlodarsk district in Semipalatinsk (it contains also graphite, 0.115; howardite, 0.395; magnetite, 2.284; Cr, trace); the olivine gave the results under II, agreeing with the formula (Mg,Fe)₃SiO₃.

Analysis III is of the meteoric iron found on the Tubil river, Ats-hinsk district, Gov. Yeniseisk.

	Fe.	Ni.	Co.	SiO ₂	Ca.	Mn.	Mg.	As.
I.	86.634	7.985	0.603	0.160	0.392	—	0.057	trace
III.	95.183	3.385	0.140	0.075	0.205	0.090	0.033	0.019

	Cl.	C.	O.	S.	CO ₂	H ₂ O.	Schreibersite.	Total.
I.	0.120	0.071	0.509	0.012	0.047	0.144	0.366	100.094
III.	0.038	0.120	0.093	—	—	—	0.425	99.806

	SiO ₂	FeO.	Al ₂ O ₃	MgO.	MnO.	SnO ₂	Total.
II.	39.80	16.34	0.27	43.68	trace	trace	100.11

L. J. S.

Waters of the Salt Lake of Urmi, Persia. By R. T. GÜNTHER and J. J. MANLEY (*Proc. Roy. Soc.*, 1899, 65, 312—318).—The water has the specific gravity 1.113 at 15° and contains about 15 per cent. of solid matter; of this, 86 per cent. is estimated to be sodium chloride, the rest consisting of magnesium chloride, magnesium sulphate, calcium sulphate, and potassium sulphate. No iodide or bromide can be detected.

J. C. P.

Physiological Chemistry.

Action of certain Derivatives of Morphine on Respiration in Man. By HUGO WINTERNITZ (*Chem. Centr.*, 1899, ii, 884—885, from *Therap. Monatsk. Sept.*).—Whilst the alkyl-morphine derivatives codeine and dionine hardly affect respiration, the acetyl derivatives, diacetylmorphine and monoacetylmorphine exacerbate breathing by stimulation of the respiratory centre. The action of morphine on respiration is thus weakened by the introduction of alkyl radicles, and increased by that of acetyl. W. D. H.

Action of the Constant Current on the Respiration of 'Surviving' Muscle. By TH. GUILLOZ (*Compt. rend.*, 1900, 130, 200—203).—In view of the treatment of maladies of nutrition (gout, obesity) with the constant current, advocated by the author, experiments on the respiration of the excised muscles of the frog were undertaken: the evolution of carbon dioxide and using up of oxygen were found to be increased during and after the use of the electrical stimulation. W. D. H.

Carbonic Oxide in Tobacco Smoke. By FRITZ WAHL (*Pflüger's Archiv*, 1899, 78, 262—285).—The carbonic oxide in tobacco smoke is taken up by the blood, but when highly diluted in this way, the gas may be breathed for 4 hours without ill results. W. D. H.

The Supposed Oxidation of Carbonic Oxide in the Living Body. By JOHN SCOTT HALDANE (*J. Physiol.*, 1900, 25, 225—229).—Wachholtz and Saint Martin have stated that carbonic oxide is converted into carbon dioxide in the body. The present experiments on mice entirely negative this. W. D. H.

The Influence of Animal Membrane on the Diffusion of Various Substances. By SVEN G. HEDIN (*Pflüger's Archiv*, 1899, 78, 205—261).—The diffusion of a large number of organic and inorganic substances was investigated with and without a membrane. The membrane used was prepared from the intestine; previous heating of the membrane makes no difference to the dialysis quotient. In all cases, the presence of a membrane hinders diffusion, but to an unequal extent. Taking dextrose as a standard, it was found that mannitol, erythritol, glycerol, glycocine, and alanine were hindered to the same extent as dextrose. The dialysis of some substances, such as alcohol, urea, urethane, and ethylene glycol, was less hindered than that of dextrose. The same is true for many neutral salts of the alkalis and alkaline earths; here the dissociation of the salts in solution forms one of the determining factors. Ammonium salts with two ions have often a greater dialysis quotient than the equally dissociated salts of the fixed alkalis, but ammonium sulphate behaved like the sulphates of the fixed alkalis. W. D. H.

Pressure Filtration of Proteids. By DAVID FRASER HARRIS (*J. Physiol.*, 1900, 25, 207—211).—The following proteids pass under pressure through a Chamberland filter: egg-albumin, serum-globulin (from sheep), serum-albumin, gelatin, acid-albumin, alkali-albumin, hæmoglobin, proteose, lactalbumin, caseinogen dissolved in alkali (1 to 30 per cent. of sodium hydroxide). The following do not: caseinogen of normal milk, caseinogen of decalcified or oxalated milk, caseinogen dissolved in lime-water, serum-globulin (from ox). The assumption drawn is that caseinogen in milk is particulate, or that its molecules are larger than those of the other proteids examined.

W. D. H.

Metabolism of a Vegetarian. By THEODOR RUMPF and O. SCHLUMM (*Zeit. Biol.*, 1899, 39, 153—158).—Particulars of the diet and excreta of the young vegetarian under observation are given. He took purely vegetable food, and presented nothing noteworthy in general health, weight, or appearance. His fæces, however, were extraordinarily voluminous. He took daily 11·82 grams of nitrogen, 698·21 grams of carbohydrate, and 28·64 grams of fat, and excreted daily 6·91 grams of nitrogen in his urine, and 4·01 in fæces; the fæces contained 7·58 grams of fat.

W. D. H.

Metabolism in Children. By WILLIAM CAMERER and FRIEDRICH SÖLDNER (*Zeit. Biol.*, 1899, 39, 37—72).—The observations first recorded were made on a girl thirty-nine weeks old, taking mixed diet. The results are given in tables, showing the composition of the diet, the growth of the child, and the composition of the excreta, including sweat. The second set of observations were similar ones upon twins; their nutriment was mother's milk. The presence of soaps in human milk is noted. The methods used are described in detail.

W. D. H.

Metabolism in Ruminants. By OSKAR HAGEMANN (*Chem. Centr.*, 1899, ii, 1030; from *Arch. Anat. Physiol.*, 1899, Suppl., 111—140 and 382).—If the oxygen used is taken as a measure of the energy that results, the sheep is much under the average values, and this is also lower than the digestive value. After the taking of food, the oxygen used increases by 5·5 per cent., which is a proof of anabolic processes that are furthered by digestion. Calorimetrically, a food of the value of 3705 Cal. is accompanied with an output of 1487 Cal., and proteid built up, 8 Cal.; this leaves 2210 Cal. for fat deposition and the needs of respiration. In the second paper, some of these figures are corrected; the figures relate only to the 8 or 10 hours following digestion, and the figure 2210 must be lessened to 1983 Cals. in order to allow for the methane that leaves the body.

W. D. H.

Metabolism of Phosphorus. By DIARMID NOËL PATON, J. CRAUFURD DUNLOP, and R. S. AITCHISON (*J. Physiol.*, 1900, 25, 212—224).—In dogs on a vegetable diet, much of the phosphorus in the food is not excreted in the urine; also a large proportion of phosphoric acid subcutaneously injected as sodium phosphate does not reappear in the urine; in the goat, none reappears, whether it is given in the food or injected under the skin. During lactation in the goat, the excretion

of phosphorus by the bowel is diminished, but under other circumstances, with the animal in phosphorus equilibrium, the absorption and excretion of phosphorus by the intestine are equal. In the dog, during lactation, the phosphorus in the urine is diminished. Goat's milk contains a high proportion of phosphorus, but less of it is in organic combination than in cow's or human milk. The administration of calcium glycerophosphate causes no rise in the phosphorus of the urine of the dog, or in the urine or milk of the goat. W. D. H.

Metabolism with Edestin. By RICHARD LEIPZIGER (*Pflüger's Archiv*, 1899, 78, 402—422).—Steinitz (Abstr., 1898, ii, 615) showed that feeding with proteids containing phosphorus yields better results so far as the putting on of phosphorus is concerned than feeding with phosphorus-free proteids *plus* inorganic phosphates. It was considered desirable to repeat this. Edestin was used instead of the myosin employed by Steinitz. The experiments were made on dogs, and Steinitz's results are confirmed. Another point investigated was the metabolic processes in which calcium and magnesium are concerned. Two experiments are recorded; in both there was a laying on of calcium in the body; in one there was a small gain, in the other a small loss, of magnesium. The results cannot be alone explained on the supposition of metabolic processes taking place in the bony tissues. W. D. H.

Metabolism during Poisoning by Pulegone. By W. LINDEMANN (*Zeit. Biol.*, 1899, 39, 1—17).—Substances which produce fatty degeneration, such as phosphorus, chloroform, and many other less thoroughly investigated materials, cause also a destructive metabolism of proteid. Pulegone, the active constituent of the ethereal oil of *Mentha pulegium*, is one of these. The substance was given subcutaneously to dogs. It causes great fatty degeneration of liver, kidneys, and heart, with hyperæmia and ulcerations of the intestines and other parts. The metabolic phenomena during the poisoning were investigated in the usual way by examining the ingesta and excreta, including the expired air. Proteid katabolism is much increased. The figures given support Voit's view that the fat originates from proteid. W. D. H.

Absorption and Excretion of Iron. By EMIL ABDEBHILDEN (*Zeit. Biol.*, 1899, 39, 113—152).—This is a contribution to a much discussed question. In the main the methods (microchemical, &c.) are like those employed by others. The animals chiefly used were rats. The principal results are that inorganic iron given by the mouth as ferric chloride is absorbed in small doses. The iron of hæmoglobin and hæmatin is also absorbable. The duodenum is the principal seat of absorption; probably Peyer's patches are also seats of absorption. Iron is excreted in cæcum, colon, and rectum. The most trustworthy method of detecting iron is by ammonium sulphide and ammonia. W. D. H.

Absorption of Sugars in the Intestine. By E. HÉDON (*Compt. rend.*, 1900, 130, 265—266).—The absorption of sugars in the intestine is related to their osmotic pressures. It is greatest for the two

hexoses studied (dextrose and galactose), less for arabinose, and very feeble in the case of raffinose.

W. D. H.

Digestion of Starch in the Stomach of Carnivora. By HANS FRIEDENTHAL (*Chem. Centr.*, 1899, ii, 1030; from *Arch. Anat. Physiol.*, 1899, Suppl., 383—390).—Although the saliva of dogs contains no ptyalin, energetic digestion of starchy food occurs in their stomachs. This is not due to a zymogen in the swallowed saliva being rendered active when it reaches the stomach, for it occurred also in the stomach of an animal fed by an oesophageal fistula, in which no saliva was allowed to enter the stomach. The starch is changed into erythrodextrin; only quite small quantities of maltose were found.

W. D. H.

Relative Digestibility of Certain Fats in the Human Intestine. III. Butter and Margarine. By H. LÜHRIG (*Chem. Centr.*, 1899, ii, 1029—1030; from *Zeit. unters. Genussm.*, 2, 769—783).—The digestibility of margarine is given as 96.75; that of butter from 96.86 to 97.13 per cent. These numbers are rather higher than those of Hultgren and Landergren. Ox-fat appears to diminish digestibility. In estimating the fat of the faeces, allowance is made for lecithin and unsaponifiable substance.

W. D. H.

Nutritive Value of Margarine compared with Butter. By E. BERTARELLI (*Exper. Stat. Rec.*, 1899, 11, 375—376; from *Riv. Ig. San. Pubbl.*, 1898, 9, 538—545 and 570—579).—The results of experiments with men showed that margarine, when properly prepared, does not differ much from butter in chemical and physical properties. When margarine was consumed, 93.5 to 96 per cent. of fat was assimilated; with butter, 94 to 96 per cent. There was no disturbance of the digestive tract when margarine was consumed in moderate amounts.

N. H. J. M.

Effects of Thyroid Feeding on Monkeys By WALTER EDMUNDS (*Proc. Roy. Soc.*, 1899, 65, 368—369).—The effect of feeding monkeys on powdered thyroid, or Hutchison's thyrocolloid, in doses varying from the equivalent of one-half to that of three sheep's thyroids daily, is exophthalmos, wasting, weakness, and death. Other symptoms noted were erection of the hair on the head, falling off of hair in patches in other parts, and paralysis of one or more limbs. Some of these are due to stimulation of the cervical sympathetic nerve. The increased secretion of the enlarged and altered thyroid in Graves's disease probably explains the exophthalmos there.

W. D. H.

The Thyroid as a Poison-removing Organ. By FRITZ BLUM (*Virchow's Archiv*, 1899, 158, 495—513. Compare Abstr., 1899, ii, 125, 779).—This is a re-statement of the author's views on the functions of the thyroid.

W. D. H.

Defence of the Organism against the Toxic Properties of Glandular Secretions. By ALBERT CHARRIN and LEVADITI (*Compt. rend.*, 1900, 130, 262—264).—If digestion juices, especially pancreatic juice, are introduced into the tissues, injury occurs. In

the intestine, it is harmless. The protection is considered to be due to the action of the mucous membrane (removal of which leads to loss of protection), of intestinal parasites, and perhaps of the blood. In the upper part of the intestine, this is believed to be aided by the layer of mucus, and the glandular secretions from the wall of the intestine.

W. D. H.

Physiology of the Suprarenal Capsules. By H. BORUTTAU (*Pflüger's Archiv*, 1899, 78, 97—128).—The paper is mainly a review of previous work on the subject; some points are amplified. The suprarenals are considered to have nothing to do with blood and skin pigments; their chief use is to render harmless the products of muscular activity, and so to regulate the nutrition and innervation of the whole motor apparatus.

W. D. H.

Influence of Alcohol on Milk Formation. By RUDOLF ROSEMAN (*Pflüger's Archiv*, 1900, 78, 466—504).—Numerous analyses, given in full detail, show that the administration of alcohol has no influence on the formation of milk, either qualitatively or quantitatively. With moderate doses, no alcohol passes into the milk; with larger doses, only from 0.2 to 0.6 per cent. of the alcohol given passes into the milk.

W. D. H.

Sodium and Potassium in the Red Corpuscles of the Blood of Animals of different Species, and in Cases of Anæmia caused by Bleeding. By FILIPPO BOTTAZZI and I. CAPPELLI (*Real. Accad. Lincei*, 1899, 8, ii, 65—73).—The authors find that with animals having nuclear red corpuscles, the latter, without exception, contain much more potassium than sodium; of the mammals examined, dog, cat, and rabbit, the last also has red corpuscles richer in potassium than in sodium. It is hence supposed that the red corpuscles of the mammals contain nucleins, the relative quantity of which determines the proportion of potassium present.

The influence of anæmia, especially when serious and protracted, is in all cases to produce a diminution in the amount of sodium and potassium in the red corpuscles. This fact, together with the decrease in the amount of nitrogen under similar circumstances, indicates that whenever the red corpuscles suffer a loss of proteids, a corresponding loss of mineral matter also occurs.

T. H. P.

Sodium and Potassium in the Red Corpuscles of the Blood during Fasting, Phosphorus Poisoning, &c. By FILIPPO BOTTAZZI and I. CAPPELLI (*Real. Accad. Lincei*, 1899, 8, ii, 107—114. Compare preceding abstract).—Fasting and phosphorus poisoning also determine diminutions in the amounts of sodium and potassium in the red corpuscles of the blood, whilst splenotomy gives no such effect. The red corpuscles of the arterial blood of a dog suffering from leucocythemia were found to contain more potassium and less sodium than the normal

From these and former researches (*loc. cit.*), it is concluded that the red corpuscles participate to some extent in the general organic metabolism and in some special cases in the progressive destruction of

the organs and that sodium and potassium are normal constituents of the proteid molecule. T. H. P.

Localisation, Elimination, and Origin of Arsenic in Animals. By ARMAND GAUTIER (*Compt. rend.*, 1900, 130, 284—291. Compare this vol., ii, 152, 168.)—The following organs (human and animal) contain arsenic: thyroid gland, 0.75 mg. per 100 grams; mammary gland, 0.13 per 100 grams; brain, variable quantity, sometimes *nil*; thymus, appreciable amount; hair, horn, skin, milk, and bone, traces only.

No arsenic could be detected in: liver, kidney, spleen, muscle, testicle, seminal fluid, pituitary gland, pancreas, mucous membrane, cellular tissue, salivary glands, suprarenal capsules, ovary, uterus, marrow, blood, urine, and faeces.

In order to ascertain the source of the arsenic found in the above organs, bread, eggs, and fish were examined, but no arsenic could be detected in them.

From these results, it will be seen that those organs which are most commonly examined for arsenic in cases of poisoning are normally free from that substance. Even if the examination be made after putrefaction has set in, and when the small amount of arsenic which is normally present in some of the organs may have possibly diffused throughout the whole system, the dilution of the arsenic would then be so great as to preclude its detection. H. R. LE S.

Universal Distribution of Titanium. By CHARLES BASKERVILLE (*J. Amer. Chem. Soc.*, 1899, 21, 1099—1101).—Beef bone is found to contain 0.0195 per cent., beef flesh 0.013 per cent., human bone, a trace, and human flesh 0.0325 per cent. of titanic oxide. E. G.

Transformation of Nitrobenzene into Aniline by a Reducing and Hydrogenating Enzyme in the Animal Organism. By J. E. ABELOUS and ERNEST GÉRARD (*Compt. rend.*, 1900, 130, 420—422. Compare Abstr., 1899, ii, 680 and 681).—When the aqueous extract of the kidney of the horse is digested with nitrobenzene and a little chloroform in an atmosphere of hydrogen at 42°, aniline is formed, but no reduction takes place if the extract is previously boiled. It thus appears that the enzyme which has previously been described as having the property of reducing nitrates to nitrites possesses an hydrogenating, as well as a deoxidising, action, a fact which is of importance in connection with the production of animal bases in the organism. N. L.

Excretion of Sulphur in Infants. By WALTHER FREUND (*Zeit. physiol. Chem.*, 1900, 29, 24—46).—The amount of the sulphur in its various forms (sulphates, alkyl hydrogen sulphates, &c.) is given for numerous sucking infants, both in health, and various forms of disease. Many cases are described in detail, and the analyses are arranged in tabular form. General conclusions from the variable results obtained are not easy to draw. W. D. H.

Influence of Peptone and Albumoses on Urinary Secretion. By WILLIAM H. THOMPSON (*J. Physiol.*, 1900, 25, 179—190).—The excretion of proteose or peptone injected into the venous system

of dogs is confined to the hour after the injection. During this time, the output of urinary nitrogen is increased, principally in the form of urea. This, however, is largely due to the salt solution used as the solvent of the proteids. At least 60 per cent. of the injected material is retained in the body; the proportion retained is greatest when deuteroproteose, amphopeptone, or antipeptone is used. It is suggested that the proteoses are held in combination as proteose-globulins in the blood.

W. D. H.

Diazo-reactions of Urine. By P. CLEMENS (*Chem. Centr.*, 1899, ii, 1028—1029; from *Deutsch. Arch. klin. Med.*, 63).—An account of numerous experiments made to ascertain the nature of the substance which gives Ehrlich's diazo-reaction in urine, but which led to no very definite result.

E. W. W.

The Pigment of the Arenicolæ. By PIERRE FAUVEL (*Compt. rend.*, 1899, 129, 1273—1275).—There exist in the integument of the *Arenicolæ* two pigments, generally described as distinct, a yellow lipochrome in the epithelial cells, and a black pigment in the form of fine granules in the upper layers of the epidermis. A solution of the lipochrome becomes brown, then black on the addition of various acids; and, it is considered probable that the formation of black granules in the cells is due to a chemical modification of the yellow pigment, under the influence of acidity, produced either in the neighbourhood of the digestive tube, or from the accumulation of waste products, the result of metabolic activity. Details concerning the pigmentation in different species are added.

W. D. H.

Ion-proteid Compounds; the Poisonous Character of Pure Sodium Chloride. By JACQUES LÆB (*Amer. J. Physiol.*, 1900, 3, 327—338).—The experiments recorded were made on fish, medusæ, and cilia. The general conclusions drawn are believed to be also true for air-breathing animals. They principally consist in translating into the new nomenclature which has arisen in connection with the modern theory of solution the work which Ringer did some years ago.

W. D. H.

Physiological Action of Bromine. By F. FESSEL (*Chem. Centr.*, 1899, ii, 885, from *Munch. med. Woch.*, 46, 1270—1273).—The experiments were performed with sodium and potassium bromide. The toxic action of bromine salts is greater in cats than in dogs. The excretion of the bromine does not rise equally with that administered until 'bromine equilibrium' is established with a sufficient dose. The chief amount of the bromide is found in the blood, where it partially replaces sodium chloride. Among the organs, the brain was the only one where it was discovered. Whether bromine will take the place of the iodine of the thyroid, is to be the subject of further work.

W. D. H.

Physiological Action of Protamines and their Decomposition Products. By WILLIAM H. THOMPSON (*Zeit. physiol. Chem.*, 1900, 29, 1—19).—The protamines are toxic; they cause a fall of blood pressure, acting like albumoses on the peripheral vessels directly; blood

coagulation is slowed, and the number of leucocytes in the circulation is lessened. The heart and respiration are also affected. Histons have a very similar action. The substances obtained by the hydrolysis of protamines (protons, hexon bases) have no such effects.

W. D. H.

Physiological Action of Morphine and its Allies. By E. IMPENS (*Pflüger's Archiv*, 1900, 78, 527—596).—The action on respiration was specially investigated. Of the substances used, heroine (diacetylmorphine) produces an effect with the smallest dose; five times as much morphine, twelve times as much dionine (ethylmorphine), twenty times as much codeine are required to produce the same or even a less effect. Peronine (benzylmorphine) has very little action at all. The danger is in about the proportion just quoted, being least with heroine and greatest with codeine. With heroine the energy of breathing and the volume of air inspired are increased, but the act is quieter, and its use is recommended in cases of tuberculosis. The other alkaloids are more uncertain and less sedative in their action. Heroine lessens the amount of oxygen consumed; codeine and dionine increase it at first and then lessen it. Morphine paralyses the irritability of the respiratory centre to stimulation by carbon dioxide, and codeine has a weaker action in the same direction. Dionine, peronine, and heroine do not act in this way. The results obtained from experiments on rabbits are applicable to man.

W. D. H.

Hæmolytic Action of Snake Toxins and Toxic Sera. By J. W. W. STEPHENS (*J. Pathol. and Bacteriol.*, 1900, 6, 273—302).—The following general conclusions are drawn from the experiments recorded:—(1) that an antitoxic serum can act on toxins other than, but allied to, that used in the preparation of the serum; (2) that the hæmolytic constituents of snake toxins, and hence snake toxins as a class, are not identical; (3) that against a minimum lethal dose of daboia toxin 0.5 c.c. of Calmette's anti-venom has very little action; (4) that the anti-hæmolytic properties of anti-venomous sera must be increased in order to afford any efficient protective serum, for instance against *Pseudechis* or daboia toxin.

W. D. H.

Sandy Matter from the Human Intestine. By R. S. THOMSON and ALEXANDER R. FERGUSON (*J. Pathol. and Bacteriol.*, 1900, 6, 334—338).—Sandy matter, passed with the fæces by a female patient suffering from a dyspeptic condition, was subjected to analysis. It was found to consist of 71.5 per cent. of inorganic, and 28.5 per cent. of organic matter. The inorganic material consisted of calcium carbonate (11.7), tricalcium phosphate (87.3), and insoluble residue (silica) (1 per cent.). Among the organic materials, particular attention was directed to the brown pigment. It was not, however, identified; its solubilities exclude any known derivative of bile pigment. It is possibly an intermediate substance between bile pigment and stercobilin. The sand is readily soluble in dilute acids. It is suggested that it is formed in the ileum, where the intestinal contents are alkaline.

W. D. H.

Milky Serous Effusions. By H. BATTY SHAW (*J. Pathol. and Bacteriol.*, 1900, 6, 339—355).—The appearance of milky, dropsical effusions is familiar to the clinical observer. This is due, in many instances to actual injury to the lacteals and escape of chyle into the body-cavity. In many cases, called chyloform, microscopic examination reveals no fat globules, and chemical examination no great quantity of fat. Often, however, minute particles, probably proteid in nature, are seen; in other cases, the opalescence may be due to proteid in solution. A case of chylous ascites and hydrothorax is here fully recorded, and compared with numerous cases described by others. The cause of the affection was a mass of lymphadenomatous glands pressing on the thoracic duct. There were no visible fat particles in the fluid, and it did not clear with ether, but became jelly-like. The urine also became jelly-like with ether, even when the albumin it contained had been removed by boiling. Normal urine does not behave so, but the same effect was noticed in other cases of albuminuria. The ascitic fluid contained 4 per cent. of solids, 2·2 per cent. of proteid, 0·52 per cent. of fat, and 0·7 per cent. of ash. W. D. H.

Acetonuria. By HUGO LÜTHJE (*Chem. Centr.*, 1899, ii, 972; from *Centr. inn. Med.*, 20, 969—973).—The appearance of acetone in the urine is held to indicate the excessive formation of acids in the organism. As strychnine produces an increased production of acids in the body (Meyer), it was given to animals; but in strychnine convulsions no acetone appears in the urine. In epileptic fits, it is also absent. It is not therefore every acid, including the lactic acids produced by muscular activity, that leads to acetonuria. W. D. H.

Excretion of Diamines in Cystinuria. By P. J. CAMMIDGE and ARCHIBALD E. GARROD (*J. Pathol. and Bacteriol.*, 1900, 6, 327—333).—Another case of cystinuria is added to the four previously recorded in which diamines have been extracted from the urine; it is the second case in which they have been extracted from the fæces also, Baumann and Udranszky's case being the first. A note added to the paper mentions a new case recorded by C. E. Simon (*Amer. J. Med. Sc. Philadelphia*, 1900, 119, 39); here they were found both in fæces and urine. In the present case, cadaverine was present in the urine, putrescine in the fæces. The diamine excretion is extremely intermittent; for no less than twenty-three successive days no diamine was found. This emphasises the necessity for prolonged investigations in other cases.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Reproduction of Yeast without Fermentation in a Limited Supply of Air. By AUGUSTE ROSENSTIEHL (*Compt. rend.*, 1900, 136, 195—198).—The vital activities of yeast cells immersed in sugar solutions manifest themselves in either of two ways, according as to

whether air is freely admitted or not; in the former case, they multiply, and in the latter they induce fermentation. Yeast colonies in apple juice from which air is excluded are frequently seen to grow without evolving any carbon dioxide, although, under these conditions, fermentation should occur. The vitality of the cell seems to be impaired by the tannin or other astringent compounds present, for when these are precipitated by gelatin, fermentation sets in; if excess of gelatin is added, so that these substances are re-dissolved, the yeast cells continue to multiply, but without evolving any gas. The addition of tannin to an artificial wort prevents its fermentation by yeast cells cultivated in apple juice. When the wort is carefully freed from dissolved oxygen, neither fermentation nor reproduction is noticed; the gelatin added to precipitate the tannin has no direct influence on the vitality of the yeast cells. G. T. M.

Decomposition of Diastase during Fermentation. By G. HEINZELMANN (*Bied. Centr.*, 1899, 25, 863; from *Zeit. Spiritusind.*, 1898, No. 41, 357).—In solutions of cane-sugar containing 0.6 per cent. of diastase, it was found that yeast destroys the diastase during fermentation. In the case of malt mash, the diastatic power decreased much less than with sugar solutions; and it was found that the presence of asparagine and other nitrogenous substances economised diastase.

A mixture of starch (160 grams) with water (to 1000 grams), to which diastase (2 grams) was added, lost 14.3 per cent. of diastase in 10 minutes at 61°. During the next 20 minutes (at 62.5°), 45.7 per cent. of the diastase was destroyed, but there was no further change during the next half-hour. N. H. J. M.

Rate of Alcoholic Fermentation. By JAMES O'SULLIVAN (*Bied. Centr.*, 1899, 25, 863; from *Zeit. Spiritusind.*, 1898, 351).—Stirring the liquid expedites fermentation, with or without an excess of yeast. In the case of maltose and dextrose, the rate of fermentation is in proportion to the amount; the rate of alcoholic fermentation of the two substances differs from the rate of the hydrolytic action of yeast on sucrose.

In presence of nutrients, fermentation is quickened, even when the amount of yeast is not increased; the cells have a more healthy appearance than in absence of nutritive matters. N. H. J. M.

Influence of Metals on Broth-cultures of Bacteria. By B. ISACHENKO (*Exper. Stat. Record*, 1899, 11, 123; from *Selsk. Khoz. Lyssov.*, 1898, 189, 35—42).—The results of experiments with *Bacillus spermophilinus* showed that when broth-cultures have to be kept more than a month, only iron vessels may be employed. Tinned iron (or lead), nickel-plated, zinc, or zinc-plated iron vessels are absolutely unsuitable for growing bacteria. Copper apparatus can only be used for keeping the culture of sterilised broth for a very short time. N. H. J. M.

Butyric Acid Fermentation. By ARTHUR SCHATTENFROH and R. GRASSBERGER (*Chem. Centr.*, 1899, ii, 1060—1061; from *Centr. Bakt. Parasit.*, 5, ii, 697—702).—Butyric acid fermentation, at any

rate as regards sugar and starch, seems only to be produced by two very similar bacteria. The one variety of butyric acid bacilli, which is mobile and does not liquefy gelatin, includes the butyric bacillus I. of Gruber, *Bacterium saccharobuty.* of Kleckli, and others. It occurs in milk, cheese, soil, and in other materials, but is not so common as the second variety which liquefies gelatin and is not mobile.

It seems probable that a pure butyric fermentation of sugar and starch does not exist, and that both the mobile and non-mobile variety always produce lactic acid as well as butyric acid, carbon dioxide, and hydrogen. Just as the quantity of alcohol produced varies, there is a difference in the relative amounts of the two acids. The production of butyric acid depends on the nature of the carbohydrate. Lactose is almost completely fermented to butyric acid by the mobile variety. The non-mobile variety produces from lactose sometimes butyric acid and a small amount of lactic acid, sometimes butyric acid alone. Dextrose, sucrose, and starch are fermented by the mobile variety mainly with production of butyric acid, whilst the non-mobile variety produces more lactic than butyric acid. The latter variety ferments galactose, maltose, and lævulose, but not cellulose and mannitol, and it attacks glycerol only slightly, with production of volatile acids and aldehyde. Both varieties coagulate casein, but without peptonisation. It is proposed to designate both varieties *Granulobacillus saccharobuty.*, with addition of *immobilis liquefac* and *mobilis non liquefac*.

N. H. J. M.

Bacteria which produce Esters. By ALBERT MAASSEN (*Chem. Centr.*, 1899, ii, 1058—1059; from *Arb. Kais. Ges.-A.*, 15, 500—513).—*Bacillus esterificans*, from putrefying litmus, in broth containing much peptone, produced hydrogen sulphide and mercaptan, but not indole or phenol, and reduced nitrate to nitrite; it did not ferment glycerol or carbohydrates, but decomposed them with production of acid.

Bacillus esterificans fluorescens (from cereals) produces a green, fluorescent dye and, during the first few days, an ester-like aroma, and subsequently an odour resembling that of trimethylamine; it does not peptonise, and reduces nitrates only slightly, does not decompose mannitol or glycerol, but decomposes dextrose and organic acids with production of acid and carbonates. *B. præpollens* (from intestine) peptonises gelatin, decomposes albumin with production of hydrogen sulphide and mercaptan, and produces much ammonium carbonate in cultures containing proteids. In cultivations, in 10 per cent. peptone, two months old, tyrosine, leucine, ammonium propionate, valerate, formate, and succinate, hydrogen sulphide, mercaptan, and an ester (probably amyl) of valeric acid were formed. It rapidly converts urea into ammonium carbonate, but does not produce carbonates from organic salts. It has no effect on nitrates, but decomposes nitrites with liberation of free nitrogen. It is pointed out that the bacillus is the first instance of a microbe which is both beneficial and injurious in agriculture. The bacillus produces esters in all nutritive media (aëration and the presence of proteids are favourable in this respect), and, unlike the

other ester-producing bacilli, retains this property. The aroma produced in milk is very agreeable.

Ester-producing bacilli were isolated from milk, Spree water, soil, and faeces. N. H. J. M.

Magnesia-gypsum as a Solid Medium for the Cultivation of Nitrifying Organisms. By V. OMELIANSKY (*Chem. Centr.*, 1899, ii, 725; from *Centr. Bakt. Parasit.*, 5, ii, 652—655).—The substance, which gave excellent results with nitrous organisms, is prepared by adding a solution of potassium phosphate (0.1), sodium chloride (0.2), magnesium, ammonium, and ferrous sulphates (0.05, 0.2, and 0.04 per cent. respectively) to a mixture of gypsum and magnesium carbonate. The mixture, which should have the consistence of sour cream, is poured on to a glass plate and then transferred to Petri-dishes or test-tubes. Plates sterilised at 120° generally absorb most of the liquid, in which case a sterilised solution of the same composition is added. After inoculation, the substance is kept in a thermostat at 25—30°.

N. H. J. M.

Denitrification Bacteria and Sugar. By HJALMAR JENSEN (*Chem. Centr.*, 1899, ii, 1061; from *Centr. Bakt. Parasit.*, 5, ii, 716—720).—In reply to Stutzer and Hartleb (this vol., ii, 97), the author expresses the opinion that the results adduced, as well as his own, do not justify the conclusion that carbohydrates as well as organic salts can serve as source of food and energy for denitrifying bacteria. N. H. J. M.

Decomposition of Nitrates by Bacteria. By S. A. SEWERIN (*Bied. Centr.*, 1899, 25, 854—856; from *Centr. Bakt. Parasit.*, 1897, 504, 554).—Out of 29 bacteria obtained from horse-dung, which were cultivated in broth containing peptone and sodium nitrate (0.3 per cent.), 18 had no effect on the nitrate, 9 reduced the nitrate to nitrite, and 2 (*Bacillus pyocyaneus*, not previously known as a denitrifying organism, and *Vibrio denitrificans*) caused still greater reduction. When the amount of nitrate was less (0.1—0.05 per cent.), 6 of the 9 cultivations reduced the nitrate completely. It is improbable that the whole of the nitric nitrogen was converted into organic nitrogen.

B. pyocyaneus and *V. denitrificans* reduce the whole of the nitrate present in 10 days when the amount is less than 7 grams per litre of broth; potassium nitrate is reduced in greater quantity than the sodium salt. The reduction also proceeds when both cultures are present, but *B. pyocyaneus* hinders the growth of *V. denitrificans*; the latter does not produce nitrites. The exhaustion of broth cultures is due to increasing alkalinity, and addition of phosphoric acid revives the denitrifying power. A portion of the nitrogen is probably converted into organic nitrogen, and a very small quantity into ammonia, when there is a slight surface aëration. Nearly all the nitrogen is liberated in the free state, perhaps mixed with oxides of nitrogen. Both microbes are undesirable in soils, especially as they are destructive both with and without access of air.

Aëration is decidedly a means of hindering denitrification and should be employed as a means of diminishing loss of nitrates.

N. H. J. M.

Soil Bacteria. By R. KOLKWITZ (*Chem. Centr.*, 1899, ii, 917; from *Centr. Bakt. Parasit.*, 5, ii, 670—678).—The so-called alinit bacillus is neither *B. megatherium* nor *B. subtilis*. Cultivations of the bacillus made in media prepared from earth-worms (which contain a substance which reduces Fehling's solution, and proteid substances which show the biuret reaction) failed to reduce nitrate, although the bacillus possesses denitrifying properties. N. H. J. M.

Soluble Ferments produced during the Germination of Seeds with Horny Albumen. By ÉMILE BOURQUELOT and HENRI HÉRISSEY (*Compt. rend.*, 1900, 130, 42—44).—The seeds of fenugreek (*Trigonella Fœnum græcum*) and lucerne (*Medicago sativa*) like the carob bean (this vol., ii, 35), when germinating, produce a soluble ferment capable of hydrolysing, in the same manner as hot dilute sulphuric acid, the carbohydrates forming part of certain horny albumens. From the albumens of the carob bean and cassia, these ferments produce mannose and galactose, together with a residue that is not readily attacked by dilute sulphuric acid (compare *loc. cit.*, and *Abstr.*, 1899, i, 839). C. H. B.

Nutrition of Plants with Organic Nitrogenous Compounds. By L. LUTZ (*Exper. Stat. Record*, 1899, 11, 316—317; from *Ann. Sci. Nat. Bot.*, 1899, [viii], 7, 1—103).—Under conditions of sterilisation, phanerogams readily assimilate methylamines, but not benzylamine and pyridine. "Phenolamines" are strong poisons, whilst compound ammonium salts and alkaloids are not available as sources of nitrogen.

Algæ and fungi gave similar results.

The organic nitrogen of beet, fruit, and fish refuse may therefore be made available for plants without nitrification or conversion into ammonia. N. H. J. M.

Regeneration of Proteids from their Products of Decomposition. By DMITRI N. PRIANISCHNIKOFF (*Landw. Versuchs-Stat.*, 1899, 52, 347—381. Compare *Abstr.*, 1899, ii, 787; also Schulze, *ibid.*, 628; Kinoshita, *ibid.*, 1896, ii, 54, and Hansteen, *ibid.*, 1898, ii, 179).—In 1896, Salezsky showed that in bulbs of *Allium cepa*, germinating in darkness, there was a possible production of proteids from carbohydrates in conjunction with amino-compounds other than asparagine, the amount of which did not decrease.

In presence of light, proteids are destroyed during germination with as much energy as in darkness. Later, when leaves develop, reproduction of proteids begins: with some plants, 10 to 15 days after germination commences, with other plants (such as *Vicia faba*), much later. Regeneration of proteids takes place either from asparagine and other amides simultaneously, or the utilisation of asparagine lingers behind that of other amino-compounds. No case, however, in which asparagine is chiefly utilised has been observed.

It is probably in the leaves that proteids are regenerated with most energy.

The experiments were made with vetches, peas, beans, yellow lupine, *Cucurbita pepo*, and *Allium cepa*. N. H. J. M.

Decomposition of Chlorophyll by Oxidising Enzymes. By ALBERT F. WOODS (*Chem. Centr.*, 1899, ii, 1126; from *Centr. Bakt. Parasit.*, 5, ii, 745—754).—Oxydases and peroxydases, which regularly occur in small quantity in all higher plants, rapidly decompose chlorophyll. Under certain conditions, not yet understood, the oxydases increase in activity or in quantity, and produce various diseases. The mosaic disease of tobacco is more probably due to enzymes than to Beijerinck's "vivum fluidum."

Oxydases and peroxydases can remain some months in the soil. The former are destroyed within five minutes at 65—70°, the latter in the same time at 80—85°. Oxydases often fail to give the blue reaction with guaiacum extract in presence of egg-albumen. N. H. J. M.

Root Secretions. By FRIEDRICH CZAPEK (*Landw. Versuchs-Stat.*, 1899, 52, 467—475).—A criticism of Kohn's experiments and conclusions (*Abstr.*, 1899, ii, 791). The author, however, considers that electrochemical methods are of importance in physiology (compare *Jahrb. Wiss. Bot.*, 1896, 29, 321, and 1898, 32, 210; also *Ber. deut. bot. Ges.*, 1897, 15, 516). N. H. J. M.

Action of Leguminous Root Nodules in Water Cultures. By FRIEDRICH NOBBE and LORENZ HILTNER (*Landw. Versuchs-Stat.*, 1899, 52, 455—465).—Experiments made with *Robinia pseudacacia* showed, in accordance with what had been previously observed, that root nodules were of little use to the host plant when grown in water culture. The structure of the nodules is altered, and they are filled with water instead of air. On pouring off some of the solution, so as to expose the upper nodules to air, the plant recovered in a few days, and soon produced new leaves of a bright green colour. Similar results were obtained by gradually replacing the water by sand; in this case, the recovery of the plants was slower, and was found to be due to the production of fresh nodules.

Whilst the nodules kept under water seemed to increase very little in size, those above the water increased greatly, many being as much as 45—50 mm. in diameter. In some cases, where the development of the nodules was greatest, the plants themselves became unhealthy, presumably owing to the withdrawal of excessive amounts of nutritive substances by the nodules. In the large nodules, the new year's growth was seen to be distinct from the older portions, and it is thought that in the case of trees a new growth in the nodules is essential for the continued supply of nitrogen.

When nodules which had been kept above the water (in 1897), and were consequently normal, were afterwards (May, 1898) covered with the solution, the growth of the plants was checked, probably owing to the nodules being prevented from forming new growth.

The results make it evident that it is in the nodules, and not in the leaves, that free nitrogen is fixed. N. H. J. M.

Physiological Functions of Solanine. By G. ALBO (*Ann. Agron.*, 1899, 25, 621—622; from A. Borzi, *Contrib. biol. veg.*, 1899, 2, Part 3).—Solanine occurs in all parts, especially in the grain, of several varieties of *Solanaceae* cultivated under ordinary conditions.

It decreases in amount during germination, and again increases when the plant is well developed. When the plants are screened from light, solanine is found in the shoots during the first period of development, but diminishes in quantity as the reserve substances are used up, and finally disappears altogether; the same occurs in presence of light when the surrounding air is freed from carbon dioxide.

When seeds of *Solanum sodomaeum* are germinated in the dark until all the solanine has disappeared, and then exposed to light, solanine is again observed as soon as the chlorophyll is well developed. *Solanum melongena*, *S. tuberosum*, and *S. lycopersicum* gave similar results.

It is concluded that solanine is not a migratory form of proteid substances, but a true reserve substance, which the plant utilises during early periods of growth, possibly after hydrolysis by acids or some diastase. Its physiological function is totally different from that of asparagine.

N. H. J. M.

Distribution of Lithium in Plants. By ERICH TSCHERMAK (*Chem. Centr.*, 1899, ii, 1127; from *Zeit. Landw. Versuchs-Wesen. Oesterr.*, 2, 560—572).—A large number of plants from the neighbourhood of Halle a/S and Geneva, and of plants which only occur in Austria, were examined. The results indicate that lithium occurs in plants to a far greater extent than was supposed. In accordance with Focke's observations, lithium is found only in the leaves, the finer portions of the stems, the flowers, and fruit. A list of plants is given in the original paper.

N. H. J. M.

Copper in Plants. By D. T. MACDOUGAL (*Exper. Stat. Record*, 1899, 11, 24; from *Bot. Gaz.*, 1899, 27, 68—69. Compare *Abstr.*, 1896, ii, 486).—The dry wood of a dead specimen of *Quercus macrocarpa* was found to contain nearly 0.05 per cent. of copper which was visible as reddish-brown particles in the tracheides, vessels, and medullary parenchyma. Plants grown in ordinary soils may contain 0.003 per cent. of copper (in the dry matter), whilst according to Lehmann (*loc. cit.*) as much as 0.056 per cent. of copper may be present in plants growing in soils containing much copper.

N. H. J. M.

Presence of Vanadium, Molybdenum, and Chromium in Plants. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1900, 130, 91—92).—The ash of Scotch fir, silver fir, vine, oak, poplar, or horn-beam, when treated with boiling water, gives a solution from which hydrogen sulphide precipitates a brown substance, which is soluble in hydrochloric acid. On spectroscopic examination of this hydrochloric acid solution, vanadium, molybdenum, and chromium are found to be present, together with traces of silicon, aluminium, manganese, and zinc.

H. R. LE S.

Green Pigment of Amanita Muscaria. By ARTHUR B. GRIFFITHS (*Compt. rend.*, 1900, 130, 42).—*Amanita (Agaricus) muscaria* contains a green pigment of the composition $C_{29}H_{20}O_{10}$, which dissolves in chloroform and ether, but the solutions show no characteristic absorption bands.

C. H. B.

Poisonous Properties of Sodium Chloride and Sea-water towards Plants. By HENRI COUPIN (*Exper. Stat. Record*, 1899, 11, 24; from *Rev. Gen. Bot.*, 1898, 10, 177—190).—Solutions containing 0.125—5 per cent. of sodium chloride were employed. The toxic strength for the different plants were: vetches, 1.1; peas, 1.2; maize, 1.4; wheat, 1.8, and lupins, 2.2 per cent.

Beta maritima and *Cakile maritima* were killed by a 4 per cent., and *Atriplex hastata maritima* by a 5 per cent. solution. These plants can withstand the amounts of sodium chloride which usually exist in sea-water.

The toxic strength of magnesium chloride and sulphate for these maritime plants is about 2.5 and 3 per cent. respectively.

N. H. J. M.

Effect of Food on the Quality of Milk. By E. O. ARENANDER (*Exper. Stat. Record*, 1899, 11, 184—185; from *Nord. Mejeri. Tidn.*, 1899, 14, 76—77 and 91).—The results of about 2000 analyses of milk showed that the percentage of fat may be reduced 1—2 per cent. below the normal by insufficient food. In Norrland (Sweden), the cows are fed from January to May on a small allowance of poor hay, from June to September on pasture, and from October to December they are liberally fed in stalls. The average amounts of fat found during the three periods are 3.2—3.3, 3.71—4.25, and 3.32—3.52 per cent. Whilst poor feeding will reduce the amount of fat, it is not believed that the fat can be increased above the normal by increasing a normal ration.

N. H. J. M.

Effect of Food on the Quality of Butter. By JOSEF L. HILLS (*Exper. Stat. Record*, 1899, 11, 385; from *Vermont Stat. Rep.*, 1898, 347—350).—The cows received, besides hay and silage, (1) gluten meal, maize meal, and wheat bran; (2) maize and bran; (3) cotton seed, linseed meal, maize, and bran; (4) bran and cotton-seed meal and (5) bran. The butter made from cows fed on ration (4) ranked lowest.

N. H. J. M.

Natural Butter, showing the Sesamé Oil Reaction. By ANTON SCHEIBE (*Bied. Centr.*, 1899, 25, 858; from *Milchzeit.*, 1897, No. 47).—A cow which received, in addition to hay, 2 kilos. of sesamé cake for a week, yielded butter which showed distinctly the Baudouin sesamé oil reaction. Pure butter is therefore liable, in Germany, to be considered as adulterated with margarine when sesamé cake is employed as food.

N. H. J. M.

Sesamé Oil Reaction of Pure Butter. By PAUL VIETH (*Bied. Centr.*, 1895, 25, 859; from *Milchzeit.*, 1898, 536).—Lehmann (*Protokoll d. Sitz. d. Centralausschusses d. k. Landw. Ges. Hann.*, Jan., 1898) showed that feeding with sesamé cake resulted in milk fat which showed the Baudouin reaction, although very slightly. Reactions of varying strength, which, if not identical with the sesamé oil reaction, differ from it inappreciably, have been universally obtained. It is therefore concluded that the admixture of sesamé oil with margarine is not suitable as a means for enabling the adulteration of butter with margarine to be detected.

N. H. J. M.

Effect of Feeding Cotton and Sesamé Cake on Butter. By THOMAS E. THORPE (*Journ. South-Eastern Agr. Coll. Wye*, 1899, No. 8, 64—65).—Three lots of four cows each received, first, linseed cake, and, subsequently, linseed, cotton and sesamé cake respectively. At the commencement, the cows received 4 lbs. of cake, in addition to dried grains (4 lbs.), bean meal (2 lbs.), hay and straw (25 lbs.), and roots (40 lbs.); afterwards, the cotton and sesamé cake were increased to 6 and 7 lbs., the bean meal being discontinued, and the grains reduced in quantity. Finally, the cows went to grass, and the oil cake was discontinued.

Under the influence of cotton cake, butter was obtained which gave the cotton seed oil reaction; the reacting substance passed into the milk within 24 hours after the cake feeding began, and continued to do so for several days after the cake was discontinued. In the case of mixed milk from several cows, the reaction is, as a rule, less than would be due to 1 per cent. of the oil. In most cases, it would be possible to differentiate between the cotton seed oil reaction due to feeding cotton cake and that due to any considerable addition to butter of margarine containing cotton-seed oil.

In the case of sesamé cake, the butter gave no sesamé oil reaction, even after the feeding, with as much cake as the cows would eat, had been continued for over two months. With large amounts of cake, the yield of milk was well maintained for some time, but the quality deteriorated and became poor in fat. As the flow of milk decreased, the cows began to get very fat.

N. H. J. M.

Nutritive Value of Asparagine. By B. K. BRUTSKUS (*Exper. Stat. Record*, 1899, 11, 275—276; from *Zap. Novo-Alexandri Inst. Selsk. Khoz. Lyesov.*, 1898, 11, 145—228. Compare Bahlmann, *Abstr.*, 1887, 512).—Experiments are described in which rabbits were fed with rice starch (640), birch sawdust (120), sugar (75), oil (30), salt (20), hay ash (20), barley ash (10), and water (34.4 grams), both with addition of and without, asparagine (150 grams). When no asparagine was given, the amount of starch was 725 grams. The nitrogen of the fæces and urine were determined.

The results indicate that the value of asparagine is much greater than that of an isodynamic amount of starch, and, that whilst asparagine cannot take the place of protein in a diet, it may economise about one-fourth of the protein in the body which would be consumed if the food contained no nitrogen.

N. H. J. M.

Vegetation Experiments in 1897. By DMITRI N. PRIANISCHNIKOFF (*Bied. Centr.*, 1899, 25, 809—815. Compare *Abstr.*, 1899, ii, 514).—Sand culture experiments were made in which barley was manured with the same amount of nitrogen in different forms. The relative yields with the different manures were: sodium nitrate, 100; blood meal, 56; stable manure, 15; and fæces, 6.5. Further experiments are described in which the various manures (N=0.5 gram) were applied to a poor, sandy soil manured with potassium sulphate. Taking the yield of the pots which had no nitrogen as 100, the yields were as follows: urine, 182; green manure (clover leaves), 156; stable

manure, 150 ; ammonium sulphate, 132 ; sodium nitrate, 126 ; blood meal, 113 ; and faeces, 86.

As regards the effect of different amounts of water in the soil on the growth of plants, it is concluded that dryness of the soil does not cause greater rapidity of growth, and that early crops in dry seasons are due to increased temperature and greater amount of light.

N. H. J. M.

Influence of Fermentation on the Value of Hay. By FRIEDRICH HOLDEFLEISS (*Mitt. Landw. Inst. kgl. Univ. Breslau*, 1899, *Heft.* 1, 59—74).—Haymaking is essentially a process of fermentation in which the amount of crude fibre is diminished whilst the remaining crude fibre is probably loosened. The amounts of other food constituents, especially the nitrogen-free extract, are relatively increased, and the hay not only acquires a better taste but its digestibility is probably greater when properly made than when dried too quickly.

Fermentation seems to diminish the amount of pentosans in hay, or at any rate in grass hay. In the one experiment with clover hay, the amount of pentosans differed very slightly in the dry matter of hay which took 9 and 16 days respectively to make (17·69 and 17·26 per cent.).

N. H. J. M.

Cultivation of White Lupins. By PIERRE P. DEHÉRAIN and E. DEMOUSSY (*Compt. rend.*, 1900, 130, 20—24).—The results of experiments extending over three years showed that white lupins only develop satisfactorily when their roots are provided with nodules, and that the nodules vary in form and size according to the source of inoculation. Nodules were produced by inoculation from vetches and from lucerne as well as from soil.

In suitable soil, the nodules are small and contain forked bacteroids, which were not found in the large nodules ; vigorous plants are then produced the dry matter of which may contain as much as 3 per cent. of nitrogen. Plants with large, smooth nodules surrounding the root contained 2 per cent. of nitrogen in the dry matter. In some cases, very large nodules like raspberries were produced ; these seem to act as parasites, the plants being much less nitrogenous ($N = 0·6—0·8$ per cent. in the dry matter).

Hairy vetch inoculation produced hemispherical nodules, whilst lucerne inoculation produced detached nodules ; the dry matter of the host plants contained 1 per cent. of nitrogen.

The frequent failure of white lupins at Grignon is attributed to absence of suitable microbes in the soil rather than to the presence of lime.

N. H. J. M.

Experiments on Potatoes. By JAMES S. GORDON (*Cheshire County Council Rep.*, 1899).—Farmyard manure gave much better results than artificial manures alone, but addition of artificial manures to farmyard manure was beneficial. Ammonium sulphate gave better results, both as regards yield and quality, than sodium nitrate, and potassium chloride produced a greater yield and better potatoes than kainite.

N. H. J. M.

Tobacco Plant. By JOHANNES BEHBENS (*Land. Versuchs-Stat.*, 1899, 52, 431—454. Compare Abstr., 1899, ii, 745).—The substance to which the brown colour of tobacco is due is not present in the fresh leaves, but is produced shortly before the natural death of the leaves when the carbohydrates are mostly consumed. When the chromogen is once formed, its oxidation proceeds in the dead leaf when sufficient moisture is present; light is unnecessary. The supposition that only ripe leaves can become brown is shown to be incorrect. Green leaves which have been killed by chloroform are unable to acquire a brown colour.

Tobacco leaves contain glucosides (probably several) and emulsin. It is thought probable that the chromogen is produced from a glucoside (compare O. Loew, *Rep.* No. 59, *U.S. Dept. of Agric.*, 1899).

N. H. J. M.

Experiments with Tobacco Fertilisers, 1892—1896. By EDWARD H. JENKINS (*Ann. Rep. Agr. Expt. Stat. Connecticut*, 21, for 1897, 243—256).—Whilst no manure will always produce the best results even on the same land, owing to the effects of climate, certain manures gave on the whole better results than others.

The liberal, but not greatly excessive, amounts of available plant food required for a good crop of tobacco may be applied in a variety of forms, and occasional changes in the forms of nitrogen and potash may be advantageous. Large amounts of chlorides and sulphates injure the quality of the leaves.

N. H. J. M.

Effect of Fertilisers on the Composition of Wrapper Leaf Tobacco. By EDWARD H. JENKINS (*Ann. Rep. Agr. Expt. Stat. Connecticut*, 20, for 1896, 322—333).—Field experiments are described in which the same manures (mostly vegetable matters, with and without addition of minerals) were applied to the same plots for four or five years.

The short wrappers were found to contain rather more ash, ether extract, and nitrogen-free extract than the long ones, and correspondingly less fibre, nicotine, nitrates, and proteids.

The different manures had no effect on the amounts of ether extract, fibre, and nitrogen-free extract; but an excess of nitrogenous manure resulted in a much larger percentage of nitrates in the leaf, amounting in one case to 1.56 per cent. of nitric nitrogen, and the percentages of proteids and nicotine were also raised. Potash manures increased the amount of potassium in the leaf ash, but the effect varies greatly with the same quantity of potassium in different forms. The leaves of plants manured with potassium sulphate may contain even less potassium than those of plants which receive half the amount of potassium in the form of carbonate. The leaf ash containing the highest amount of calcium (and the least amount of potassium) was obtained by manuring with potassium sulphate.

Tobacco manured with stable-manure yielded an ash containing five times as much chlorine as the ash from any of the other plots.

N. H. J. M.

Manurial Experiments on Permanent Pasture. By W. J. MALDEN (*East Sussex County Council Rep.*, 1899).—The soil on which the experiments were made was more or less exhausted by dairying and stock raising, and the pasture poor. As regards mineral manures, phosphoric acid, in which the soil was deficient, gave much the best results when applied in the form of basic slag. Kainite had very little effect.

Nitrogen as sodium nitrate was useless without phosphates, whilst ammonium sulphate alone slightly improved the quality of the grasses. In conjunction with basic slag, sodium nitrate produced inferior grasses as compared with basic slag and ammonium sulphate.

Farmyard manure, in conjunction with basic slag, gave a great increase in weight, and at the same time improved the quality.

Detailed results of botanical separations of the herbage of the various plots are given as well as percentages of gramineous, leguminous and miscellaneous plants.

N. H. J. M.

Field Experiments for determining the general Manurial Requirements of Typical Soils with Reference to Chemical Soil Analysis. By P. BAESSLER (*Bied. Centr.*, 1899, 25, 815—820; from *Ber. Agrik.-Chem. Versuchs-Stat. Köslin* for 1897, 45).—Field experiments were made on soils of different kinds after the soil had been analysed by the official methods. The total and citrate soluble phosphoric acid, the total calcium and calcium carbonate, potassium soluble in 10 per cent. hydrochloric acid, and the nitrogen were determined.

The results of field experiments showed that relations existed between the effects of potash manures and the percentage of potassium in the soil; in the case of phosphoric acid, the results were more irregular, whilst with nitrogen the results were indefinite.

With lime and complete minerals, 21 per cent. of the phosphoric acid was utilised; in absence of potassium and in absence of nitrogen, only 18 and 14 per cent. respectively of the phosphoric acid was utilised. When nitrogenous manure alone was applied, only 28 per cent. of the nitrogen of the manure was taken up by the crop, the amount being increased to 59, 74, and 86 per cent. respectively, when in addition to nitrogen, potassium, phosphoric acid, and complete minerals respectively were applied.

Analyses of the soils and of the crops are given.

N. H. J. M.

Pot Experiments on the Action of Lime and Magnesia in Burnt Lime and Marls. By RICHARD ULBRICHT (*Landw. Versuchs-Stat.*, 1899, 52, 383—430).—A large number of experiments are described in which different amounts of calcium and magnesium oxides and carbonates were applied to different plants, chiefly lupins.

Even with abundance of potash, lupins were injured by slight amounts of lime, and 500 or 1,000 kilos. of lime per morgen caused a considerable reduction in the yield. Lime, containing magnesia (250 kilos.) gave irregular results, but 500 kilos. of the mixtures much reduced the yield, especially when the percentage of magnesia was high. Similar results were obtained with barley and vetches. In experiments with lupins after radish, it was found that the injurious effects of excessive liming extended to the second year.

Application of powdered magnesite (MgCO_3 , 76.4; CaCO_3 , 18.4 per cent., 500 kilos. per morgen) applied in the spring increased the yield of lupins considerably.

Calcium carbonate, as marls and powdered marble, invariably reduced the total yield of the leguminous plants when applied in large amounts, but in the case of lupins to a less extent than burnt lime. (compare R. Heinrich : *Mergel und. Mergeln Berlin*, 1896).

N. H. J. M.

Analytical Chemistry.

Ammonium Dithiocarbonate as a Substitute for Hydrogen and Ammonium Sulphides. By M. VOGTHER (*Zeit. anal. Chem.*, 1900, 39, 44; from *Ber. deutsch. pharm. Ges.*, 8, 228).—The reagent is prepared by shaking 5 parts of carbon disulphide with 9 parts of 22 per cent. ammonia until it is completely dissolved. Hydrochloric or acetic acid is then added until the precipitate produced dissolves only slowly, and the mixture is diluted with water to three or four times its volume. In most, but not in all cases, this reagent can be employed instead of hydrogen sulphide or ammonium sulphide, and in the original paper a scheme for its employment in qualitative analyses is drawn up.

M. J. S.

Volumetric Estimation of Hydrogen. Diffusion of a Solid into a Gas. By ALBERT COLSON (*Compt. rend.*, 1900, 130, 330—332. Compare this vol., ii, 140).—Silver hydroxide, obtained by adding a solution of potassium hydroxide to a solution of silver nitrate, when dried at 110° — 120° , has very nearly the composition AgOH . This compound absorbs hydrogen even at 0° , but more readily when heated at 100° , water and metallic silver being produced; neither methane, ethane, nor oxygen are absorbed by it, so that it may be used for the estimation of hydrogen in a mixture of one or more of the above gases.

At 0° , the rate of absorption of hydrogen by silver hydroxide does not vary with the amount of surface of solid in contact with the gas. When the amount of hydroxide present is from 2.0—0.75 grams, then the rate of absorption is practically constant, and this may be explained, if we assume that, in the presence of hydrogen, the hydroxide exerts a true vapour pressure. The reduced silver is deposited along the sides of the tube and not at the place where the hydroxide originally was, and since this phenomenon occurs even at 0° , it must be regarded as a true example of the diffusion of a solid into a gas.

H. R. LE S.

Iodometric Process for the Analysis of Mixtures of Chlorate and Hypochlorite. By HUGO DITZ and HEINRICH KNÖPFELMACHER (*Zeit. angew. Chem.*, 1899, 1195, 1198, 1217—1220).—Chlorates, in the presence of potassium iodide and hydrochloric acid, liberate iodine,

but the reaction is slow and uncertain and therefore not suitable for quantitative purposes. If, however, a solution of a chlorate is mixed with potassium bromide and a sufficiency of hydrochloric acid, bromine is liberated quantitatively and may then be estimated by the usual iodometric method. Hypochlorites behave similarly. 25 c.c. of the solution containing approximately 0.06 gram of the chlorate are mixed in a generating flask with 20 c.c. of a 5 per cent. solution of potassium bromide and 50 c.c. of strong hydrochloric acid are added from a separating funnel, the air which escapes from the flask passing through a bulb containing solution of potassium iodide to retain any bromine vapour. After 1 hour, the liquid is titrated as usual. Any hypochlorite is estimated by the Penot method and allowed for.

L. DE K.

Estimation of Sulphuric Acid in the presence of Iron. III. By FRIEDRICH W. KÜSTER and A. THIEL (*Zeit. anorg. Chem.*, 1900, 22, 424—444. Compare Abstr., 1899, ii, 247 and 611).—A large number of experiments on the estimation of sulphuric acid in the presence of iron gave the following results. When a hot solution of sulphuric acid containing ferric salts is precipitated with barium chloride, the barium salt of the complex ferrisulphuric acid, $\text{Ba}(\text{Fe}_2\text{S}_2\text{O}_8)_2$, is contained in the precipitate, and this causes a loss which may amount to as much as 7 per cent. of the sulphuric acid. This formation of the complex salt can be prevented (i) by previous precipitation of the ferric salt with ammonia (ii) by converting the ferric salt into a complex salt, as, for instance, with ammonium oxalate; (iii) by precipitation in the cold, and (iv) by adding the hot solution of sulphuric acid and ferric salt to the barium chloride. The conversion of the ferric salt into ferrous salt by means of zinc, &c., is not recommended, for although the loss due to the formation of the complex acid is avoided, other much smaller errors are introduced by the precipitation of zinc sulphate and ferrous sulphate together with the barium sulphate.

E. C. R.

Estimation of Nitric Acid in Water. By MAX HÖNIG (*Chem. Centr.*, 1199, ii, 1032; from *Festschr. Hochschule Brünn*, 1899).—The Marx-Trommsdorff process is recommended. The sample should contain about 0.001 gram of nitric pentoxide per 25 c.c. and must therefore, if needful, be suitably diluted or concentrated.

The indigo solution is prepared by dissolving 1.4200 grams of sodium or 1.5407 grams of potassium indigotintrisulphonate in 1 litre of water; of this, 5.5 c.c. mixed with 50 c.c. of sulphuric acid are used in the test.

L. DE K.

Estimation of Nitrates. By CHARLES M. VAN DEVENTER (*Zeit. physikal. Chem.*, 1899, 31, 50—58).—A new method is described, depending on the brown coloration produced on mixing solutions of ferrous sulphate and a nitrate in presence of sulphuric acid. If the ferrous sulphate solution is gradually added to the nitric acid solution, the brown coloration, which is due to the evolved nitric oxide dissolving in the ferrous sulphate solution, is not persistent until all the nitric acid has been used up in oxidising the ferrous salt. As the accuracy of the

reaction necessitates the absence of air, the method is carried out as follows. A non-graduated tube, open at one end and fitted at the other with a tap and funnel, is filled with mercury and placed funnel upwards in a mercury trough; into this tube about 1 c.c. of bromoform is introduced in order that the nitric and sulphuric acids may not come into direct contact with the mercury. By means of the funnel and tap, a measured volume (5 c.c.) of the nitrate solution, and, after the funnel has been washed with a little water, 8 c.c. of concentrated sulphuric acid are brought into the tube. Standardised ferrous sulphate solution is then allowed to flow up into the tube from a burette with a turned up point; when the end of the reaction is near, a further 8 c.c. of concentrated sulphuric acid are added by the funnel and the addition of the ferrous solution carefully continued until the liquid in the tube is of a distinct reddish-brown tint, the volume of ferrous solution added being read off. The presence of an excess of ferrous salt is confirmed by pouring the contents of the tube into water and adding potassium ferricyanide solution. Although it is known that 1 mol. of nitric acid oxidises 3 mols. of ferrous salt, it is best to determine the strength of the ferrous solution by carrying out a test with a nitrate solution of known strength. The funnel tube should not be too long, or the contents are liable to become too cold.

As regards substances interfering with the process, coloured solutions are of course inadmissible, as also is the presence of compounds giving a precipitate or coloration with sulphuric acid. Any carbonates in the liquid to be tested should be removed by the addition of a little acid.

T. H. P.

Detection and Estimation of very small quantities of Nitrous Acid. By HUGO ERDMANN (*Ber.*, 1900, 33, 210—215).—1-Amino-8-hydroxynaphthalene-4:6-disulphonic acid, which is prepared from 1:3:5-naphthalenetrisulphonic acid by nitration, reduction and treatment with soda (*Chem. Ind.*, 1898, 523), gives in acid solution a bright Bordeaux-red coloration with nitrous acid. The reaction is more delicate than that given by the other reagents proposed for the detection of nitrous acid in water, and is employed in the following manner: 50 c.c. of the water to be tested are mixed with 5 c.c. of an acidified solution of sodium sulphanilate (containing 2 grams of the sodium salt per litre) and about 0.5 gram of the solid aminonaphtholdisulphonic acid added in the form of acid sodium salt mixed with sodium sulphate. The coloration reaches its maximum intensity in about an hour and may be compared colorimetrically with that produced by a known amount of a standard nitrite solution.

A. H.

Estimation of Phosphoric Acid Soluble in a 2 per cent. Solution of Citric Acid. By ALEXANDER HERZFELD (*Chem. Centr.*, 1899, ii, 1139; from *Zeit. Ver. Rüben-Zuck. Ind.*, 1899, 862—863).—When basic slags are treated with a 2 per cent. solution of citric acid, a notable amount of silicic acid dissolves, and passes first into the phosphomolybdate and afterwards into the magnesium phosphate precipitate. In one instance, the amount of phosphoric acid as estimated in this manner was found to be 3.6 per cent. in excess of the truth.

L. DE K.

Phosphates and the Humic Acid Process. By WILHELM HOFFMEISTER (*Landw. Versuchs-Stat.*, 1899, 52, 329—345. Compare Abstr., 1898, ii, 538).—In the extraction of phosphates by ammonium humate, the lime of the calcium phosphate is converted into carbonate or humate, whilst the phosphoric acid enters into combination with ammonia and alkalis. The solution takes place most readily in such phosphates as superphosphate and basic slag.

Silicic acid always dissolves along with the phosphoric acid, and as a rule the silica dissolved increases with the phosphoric acid. The presence of soluble silica increases the solubility of the phosphoric acid, so that more phosphoric acid is dissolved when fresh sand (containing soluble silica) is employed than with exhausted sand. It was found that whilst 150 grams of pure sand yielded 0.0104 gram of silica soluble in ammonium humate, the addition of 5 grams of sodium phosphate increased the amount of silica to 0.0368 gram.

It is probable, therefore, that in soils the soluble silica is of importance in increasing the availability of the phosphoric acid, and it is supposed that the supply of soluble silica becomes periodically exhausted.

Estimations of phosphoric acid and potash in soil were made by the humic acid method, and the results compared with the amounts dissolved by hydrochloric acid.

N. H. J. M.

Biological Detection of Arsenic in Skin, Hairs, Perspiration, and Urine. By W. SCHOLTZ (*Chem. Centr.*, 1899, ii, 1032—1033; from *Berl. klin. Woch.*, 36, 913—915).—Abba's process of acting on these substances with the fungus *Penicillium brevicaulis* and observing the garlic odour given off after some time if arsenic should be present, is much more delicate than Marsh's test: even 1/200—1/500 part of a milligram may still be detected.

The odour of urine, which interferes somewhat with the test, may be removed by means of animal charcoal.

L. DE K.

Stannous Chloride and Bettendorf's Test for Arsenic. By F. DIETZE (*Zeit. anal. Chem.*, 1900, 39, 44—45; from *Pharm. Zeit.*, 1897, 191).—Stannous chloride, to be fit for use in Bettendorf's test, must be free from ammonium salts, sulphates, iron and arsenic, all of which, besides other impurities, may be present in the commercial salt. When a solution of 1 gram dissolved in 5 c.c. of hydrochloric acid of sp. gr. 1.19, is boiled for several minutes, the solution must remain clear and colourless for an hour. When titrated with iodine, it should show a purity of at least 98.5 per cent.

M. J. S.

Bettendorf's Arsenic Test. By HENRIK ENELL (*Zeit. anal. Chem.*, 1900, 39, 45; from *Nord. Farm. Tidsskrift.*, 1896, No. 12).—Arsenic acid is much more slowly reduced by stannous chloride than is arsenious acid; heat accelerates the reaction. To detect traces of arsenic, the author filters the liquid through a very small filter, which is then spread out upon white paper. Arsenic appears as a reddish-brown stain.

M. J. S.

Bettendorf's Arsenic Test. By G. FREERICHs (*Zeit. anal. Chem.*, 900, 39, 45—46; from *Apoth. Zeit.*, 1897, 176).—The reaction is

capable of detecting 0.06 milligram of arsenic in the form of arsenic acid or 0.013 milligram in the form of arsenious acid. Gutzeit's test is equally sensitive. The test cannot be absolutely depended upon; traces of mercury may be mistaken for arsenic. M. J. S.

Constitution of the Ammonium Magnesium Arsenate of Analysis. By MARTHA AUSTIN (*Amer. J. Sci.*, 1900, [iv], 9, 55—61).—A precipitate of ideal condition may be obtained by adding to the faintly acid solution of an arsenate (not exceeding 200 c.c.) magnesia mixture (110 grams of crystallised magnesium chloride, and 58 grams of ammonium chloride are dissolved in water and diluted to 2 litres; 10 c.c. of ammonia are then added) amounting to about 30 c.c. in excess of that theoretically needed. The precipitate is collected and transferred to the filter by means of the filtrate, when washing with about 25 c.c. of faintly ammoniacal water will be sufficient to free it from soluble impurities. No arsenic will be found in the filtrate or washings. If, however, the liquid contains excess of ammonium chloride, a precipitate is obtained which is richer in ammonia and yields on ignition a residue containing some meta-arsenate. Much ammonium chloride also increases the solubility of the compound, although this is again lessened by excess of magnesia mixture. L. DE K.

Estimation of Carbon, Copper, and Manganese in Iron By OTTO HERTING (*Zeit. angew. Chem.*, 1899, 1193—1194).—A reply to Murmann on the subject of the estimation of carbon, copper, and manganese in pig-iron, wrought-iron, and steel.

Heid's process is recommended for the estimation of the carbon. The iron is dissolved in copper-ammonium chloride, the impure carbon is collected on an asbestos filter, and well washed with hot water, and then with alcohol and ether. The filter is transferred to a Rose's crucible, dried at 120°, and weighed; the carbon is then burnt in a current of oxygen, and is represented by the loss in weight. To estimate graphite, the sample is dissolved in dilute nitric acid and the insoluble matter treated as above. Murmann's statement, that the copper cannot be estimated in the liquid obtained when dissolving the sample in hydrochloric acid for the purpose of estimating the sulphur, is baseless, as small quantities of copper entirely dissolve.

Manganese is best estimated volumetrically.

L. DE K.

Microchemical Detection of Potassium, Rubidium, Cæsium, Indium, and Thiosulphates. By A. C. HUYSE (*Zeit. anal. Chem.*, 1900, 39, 9—11).—Sodium bismuth thiosulphate, prepared as follows, is a highly sensitive reagent for the detection of potassium, cæsium, and rubidium. A little basic bismuth nitrate is dissolved in the smallest possible quantity of hydrochloric acid, and water is added until a thick, white precipitate is formed, which is then dissolved by the addition of sodium thiosulphate, avoiding excess. Strong alcohol is added until a permanent turbidity is produced, and this is cleared up by adding a little water. The reagent must be freshly prepared. The liquid to be tested must either be evaporated to dryness on a glass slide, or mixed with the same

proportion of alcohol as is contained in the reagent. Salts of potassium, caesium, and rubidium give with this reagent characteristic, yellowish-green, acicular, monoclinic crystals. Salts of the alkaline earths produce a white precipitate, which cannot be confused with the above, but salts of ammonium and the other metals give no precipitate, and do not interfere with the test. Visible crystals were obtained from 0.002 mg. of potassium nitrate.

Cæsium chloride produces, in solutions of indium sulphate containing a little free sulphuric acid, octahedra of caesium indium alum. Ammonium fluoride also produces octahedral crystals, resembling those obtained from aluminium salts. For the employment of these two tests, aluminium, and, for the latter, iron, must be absent. Mercuric thiocyanate is also a sensitive reagent, yielding crystals which differ somewhat from the zinc and cadmium mercuric thiocyanates. Oxalic acid and ammonium oxalate are highly sensitive tests, producing crystals which resemble zinc oxalate, but are insoluble in ammonia. These two reactions are only characteristic of indium in the absence of zinc, cadmium, cobalt, copper, and iron.

Minute quantities of sodium thiosulphate (0.01 mg.) can be detected by adding thallous nitrate in excess, when tabular and cruciform crystals are formed. Sulphates, nitrates, and acetates do not interfere with the reaction, but haloid salts prevent it.

M. J. S.

Precipitation of Silver Chloride by Dimercurous Ammonium Chloride. By F. LETEUR (*Compt. rend.*, 1900, 130, 248—250).—In the ordinary method for the detection of silver in the presence of mercurous salts, the chlorides of the two metals are treated with ammonia, and if the silver chloride is present in relatively large quantities, a considerable amount is rendered soluble. When the mercurous salt preponderates, a large proportion, or even the whole, of the silver chloride remains undissolved, the precipitate of dimercurous ammonium chloride always retaining a notable quantity of the silver salt; under these conditions, the insoluble portion is treated with aqua regia, in order to convert the mercury compound into soluble mercuric chloride, and the final residue is examined for silver.

G. T. M.

Estimation of Calcium by the Citrate Method. By MAX PASSON (*Zeit. angew. Chem.*, 1899, 1153—1155. Compare Abstr., 1898, ii, 642).—The process has been slightly modified. Instead of a 10 per cent., a 2 per cent. solution of citric acid is employed. The solution containing the calcium, and also iron, aluminium, and perhaps phosphoric acid, is neutralised with ammonia, and the precipitate formed redissolved by means of the citric acid solution; 20 c.c. more of this are then added, and after diluting with water, the solution is heated to boiling and precipitated with large excess of ammonium oxalate.

Manganese, if present to any large extent, must be previously removed. It has been found that the results are trustworthy; those obtained by precipitating the iron and aluminium by the acetate method, and then precipitating the calcium in the filtrate, are in excess of the truth.

L. DE K.

Estimation of Thallium as the Acid and Normal Sulphates. By PHILIP E. BROWNING (*Amer. J. Sci.*, 1900, 9, 137—138).—Thallium may be accurately weighed as normal sulphate, as already suggested by Crookes. The solution containing thallous nitrate or chloride is mixed with sulphuric acid, evaporated to dryness, and gradually heated to redness, until the weight is constant. Normal thallous sulphate is thus formed.

The author states that, by drying at 220—240° to constant weight, the acid sulphate is obtained, which may then be weighed. The results are quite satisfactory. L. DE K.

Detection of Copper. By DIOSCORIDE VITALI (*Chem. Centr.*, 1899, ii, 990—991; from *Boll. Chim. Farm.*, 38, 665—668).—See this vol., ii, 208.

Estimation of Mercury in Urine. By SCHUMACHER and W. L. JUNG (*Zeit. anal. Chem.*, 39, 12—18).—A litre of the urine is warmed on the steam-bath, with addition of 100 c.c. of concentrated hydrochloric acid and 15—20 grams of potassium chlorate, in a flask with inverted condenser. When the mixture, which at first is deep red, has become pale coloured, it is left for 12 hours in the cold to complete as far as possible the destruction of the organic matter by the nascent chlorine. It is then warmed to expel most of the chlorine, and precipitated with about 100 c.c. of strong, clear, stannous chloride solution. The precipitate is collected on an asbestos filter, which is then transferred to a small flask and warmed with potassium hydroxide solution. Potassium chlorate and excess of hydrochloric acid are again added, by which means the last traces of organic matter are destroyed and the mercury again dissolved. The solution is filtered, and again reduced with stannous chloride. The mercury is now collected on a filter of gilt asbestos mixed with small granules of gold. The gilt asbestos is prepared by steeping purified asbestos in a strong solution of gold chloride, and reducing by heating for 15 minutes in pure hydrogen; it is then washed with dilute hydrochloric acid and hot water, and dried. Such a filter arrests every trace of mercury. The filter is then washed with hydrochloric acid, water, alcohol, and ether, and dried in a current of dry air until its weight is constant. It is then heated strongly enough to expel the mercury from the gold amalgam and again weighed. Test analyses in which 2.5 and 4.4 mg. of mercury (in the form of mercuric chloride) were added respectively to a litre of urine, gave fairly close results, but when less than 1 mg. is present the results are only approximate. M. J. S.

New Method of Estimating Aluminium. By ALFRED STOCK (*Compt. rend.*, 1900, 130, 175—178, and *Ber.*, 1900, 33, 548—553).—When a neutral or slightly acid solution of aluminium sulphate is treated with excess of a solution containing potassium iodide (5 mols.) and potassium iodate (1 mol.), iodine is liberated, and aluminium hydroxide is precipitated in accordance with the following equation: $\text{Al}_2(\text{SO}_4)_3 + 5\text{KI} + \text{KIO}_3 + 3\text{H}_2\text{O} = 2\text{Al}(\text{OH})_3 + 3\text{K}_2\text{SO}_4 + 3\text{I}_2$. The free iodine is removed by adding sodium thiosulphate, and the mixture heated to boiling, the hydroxide being thus obtained as a flocculent precipitate readily filtered and washed. The precipitation is complete, and unless

a large excess of sulphate is present in the original solution, the product is free from sulphur. When phosphoric acid is present, the precipitate, after ignition, has the composition $2\text{Al}_2\text{O}_3, \text{P}_2\text{O}_5$. If the mixture is heated for one hour, and if sufficient potassium iodide is added to redissolve the liberated iodine, the use of thiosulphate may be avoided and the aluminium hydroxide thus produced is even more amenable to subsequent treatment, but on account of the difficulty attending the filtration of a hot solution of iodine the author recommends the first method.

G. T. M.

Estimation of Titanic Acid in Iron Ore. By JAS. BRAKES (*J. Soc. Chem. Ind.* 1899, 18, 1097).—One gram of the ore is dissolved in hydrochloric acid, the solution is diluted and filtered; the undissolved matter is fused with potassium-sodium carbonate, the fused mass dissolved in hydrochloric acid and united with the main solution. After nearly neutralising with ammonia, 50 c.c. of sulphurous acid are added, and when the liquid has become colourless it is boiled for 30 minutes, the volume being kept constant with sulphurous acid. This causes a precipitate of titanate of iron, which is then collected and washed with hot water. After burning it in a platinum crucible, it is moistened with dilute sulphuric acid, a few c.c. of hydrofluoric acid are added, the whole is evaporated to dryness to expel any silica, and then strongly ignited; the titanium is then weighed as dioxide.

L. DE K.

Quantitative Separation of Tin, Antimony and Arsenic. By RICHARD MARBURG (*Zeit. anal. Chem.*, 1900, 39, 47—56).—The author reproduces Dancer's paper on this subject (*Abstr.*, 1898, ii, 311) with remarks on the various stages of the process. He confirms the exactness and convenience of the lime method for separating tin from antimony, but regards the separation of arsenic and antimony in the filtrate as less exact, and prefers to operate as follows. The antimony and arsenic are precipitated as sulphides, which after washing are digested with a large quantity of potassium hydroxide. The solution is saturated with chlorine and the two metals then separated by Bunsen's method (*Annalen*, 1878, 192, 317). In this separation the presence of too much hydrochloric acid must be avoided. The antimony pentasulphide must be converted into trisulphide by prolonged heating at 230° in Paul's apparatus (*Abstr.*, 1893, ii, 90), but it is better to convert it into tetroxide. Sulphides of the three metals, when precipitated by hydrogen sulphide from an acid solution, are very slowly attacked by lime-water; it is preferable to redissolve them in colourless potassium sulphide and reprecipitate by an acid in the cold.

M. J. S.

Simplification of the Phenylhydrazine Test for Sugar. By ALBERT NEUMAN (*Chem. Centr.*, 1899, ii, 1033; from *Arch. Anat. Phys. Physiol. Abt.*, 1899, *Suppl.*, 549—552).—5 c.c. of the liquid to be tested, for example, diabetic urine, are mixed with 2 c.c. of acetic acid previously saturated with sodium acetate, 2 drops of phenylhydrazine added, and the liquid concentrated to 3 c.c. When cold, characteristic crystals of the osazone will be noticed if sugar is present.

L. DE K.

Estimation of Sucrose in Condensed Milk. By LEO GRÜNHUT and SEVERIN H. R. RIIBER (*Zeit. anal. Chem.*, 1900, 39, 19—36).—For the estimation of two sugars occurring together, three methods are possible; (1) Estimation of the reducing power before and after inversion; (2) estimation of the optical rotation before and after inversion; (3) estimation of reducing power and rotation without inversion. The authors discuss the advantages of the three methods for the purpose of estimating the sucrose in condensed milk in the presence of the lactose, and find the first and third methods wholly inapplicable. The second method, with certain precautions, gives satisfactory results. The solution must be prepared by treating the condensed milk with boiling water and cooling the solution to exclude the influence of multirotation. Hydrochloric acid is employed for the inversion. If used according to the so-called *Zollvorschrift* (*Zeit. anal. Chem.*, 32), it is found to have no influence on the rotatory power of any of the constituents of normal milk. Both the optical observations must be made at exactly the same temperature; 20° is preferred. Lead acetate, avoiding a large excess, may be employed for precipitating the casein, &c., but the volume of the precipitate must not be neglected. The adoption of Scheibler's method of two different dilutions overcomes this difficulty. Thus, if R is the rotation when the total volume is V , and r when the volume is v , the equation $V - x/v - x = R/r$ gives x , the volume of the precipitate, and, by subtraction, the real volume of the solution. The conventional method of multiplying by the empirical factor 0.962 gives accurate results with only one particular mixture. The Clerget formula employed by Herzfeld, $Z = 100(P - J)/131.84 - 0.05 J$ is to be preferred to $Z = R - J/1.3266$. M. J. S.

Source of Error in the Detection of Sugar in Urine by means of Fehling's Solution. By J. EURY (*Bull. Soc. Chim.*, 1900, [iii], 23, 41—44).—Certain specimens of urine, which are shown by their density and by polarimetric observations to contain notable quantities of sugar, decolorise Fehling's solution when boiled therewith, but yield no precipitate of cuprous oxide. When left to cool, the upper layers of the liquid assume a reddish-brown colour, and a brown precipitate is gradually deposited; this, however, does not take place when the liquid is cooled out of contact with air, nor when the liquid, thus cooled, is afterwards exposed to the air. The reaction is shown to be due to the combination of creatinine and similar bases with cuprous oxide to form soluble compounds, which subsequently undergo oxidation with the precipitation of cupric oxide or a compound thereof with the base. The substances thus interfering with the detection of sugar in urine may be removed by precipitation with mercury, but not with lead salts. N. L.

Caramel Substances. II. Estimation of Caramel in Aqueous Solutions by means of the Spectroscope. By F. STOLLE (*Chem. Centr.*, 1899, ii, 1099; from *Zeit. Ver. Rübenzuck.-Ind.*, 1899, 839—841).—The method of determining the amount of caramel by means of the spectroscope is based on the property of aqueous solutions of this substance of partially absorbing the rays of the blue end of the spectrum. Caramel is insoluble in absolute ethyl alcohol, but easily

soluble in methyl alcohol, hence it may be readily separated from solutions which contain other active substances. The results obtained are accurate within 0.05 per cent. E. W. W.

Estimation of Cellulose in Fæces. By KONRAD MANN (*Chem. Centr.*, 1899, ii, 1139; from *Arch. Hyg.*, 36, 158—165).—The process recommended by Weender, does not yield a pure cellulose, as this still retains nitrogenous matters, notably elastin. L. DE K.

König's Process for the Estimation of Crude Fibre free from Pentosan. By OSCAR KELLNER, FR. HERING and O. ZAHN (*Chem. Centr.*, 1899, ii, 1033—1034; from *Zeit. Unters. Nahr.-Genussm.*, 2, 784—786).—König's glycerol process (*Abstr.*, 1899, ii, 68) is recommended as being a notable improvement in fodder analysis. L. DE K.

Separation and Estimation of Formic, Acetic, Propionic, and Butyric Acids. By J. SCHÜTZ (*Zeit. anal. Chem.*, 1900, 39, 17—18).—The author is unable to confirm the accuracy of Haberland's method (*Abstr.*, 1899, ii, 531) on the ground that formic, acetic, and butyric acids when evaporated with excess of zinc oxide are not completely converted into their zinc salts, but partially volatilise. The loss increases with increase of the molecular weight of the acid; in one experiment with butyric acid, it amounted to 82 per cent. Similar results were obtained with lead oxide. M. J. S.

Determination of the Solidifying Point of Fatty Acids. By I. FREUNDLICH (*Chem. Zeit.*, 1899, 23, 1014).—This is a slight modification of the Dalican process, consisting in stirring with a delicate thermometer and noticing the sudden rise of the mercury. It is now recommended not to commence the final stirring until the solidifying point is almost reached. L. DE K.

Estimation of Unsaturated Fatty Acids in Fish Oils. By HENRIK BULL (*Chem. Zeit.*, 1899, 23, 1043—1044).—7 grams of the sample are saponified by boiling with 25 c.c. of solution of sodium ethoxide made by dissolving 23 grams of metallic sodium in absolute alcohol and diluting to a litre; the flask containing the mixture is attached to a reflux condenser. When cold, 144.2 c.c. of anhydrous ether are added, the flask stoppered, and frequently shaken for some hours, when the solution is passed through a dry filter, precautions being taken to minimise loss by evaporation. 100 c.c. of the filtrate (= 4 grams of sample) are now shaken thrice in succession with 20 c.c. of water containing a little sodium hydroxide; this treatment removes the sodium salts of the saturated fatty acids, whilst the unsaturated compounds remain in the ethereal liquid. The acids may then be recovered in the usual manner.

A table is given of the analytical data of a large number of marine and fish-oils. L. DE K.

[**Estimation of Calcium Malate in Crude Tartar.**] By CHARLES ORDONNEAU (*Bull. Soc. Chim.*, 1900, [iii], 23, 14—15).—2 grams of the finely powdered tartar are boiled with 100 c.c. of water,

and the liquid filtered, evaporated to about 20 c.c., mixed with 2 c.c. of acetic acid, agitated, and left to cool. The precipitated calcium tartrate is separated by filtration and the filtrate and washings concentrated to about 10 c.c., mixed with 75 c.c. of 93 per cent. alcohol, and the calcium malate thus precipitated collected, washed with alcohol, and dried at 100°. The small quantity of calcium tartrate still mixed with the malate may be estimated by washing the precipitate with water and again drying at 100°. This process, which is based on the properties of calcium tartromalate, may be used for the estimation of malic acid in green grapes, but is not applicable to wines, which contain gummy substances precipitated by alcohol along with the calcium malate.

N. L.

Estimation of Uric Acid based on Precipitation as Ammonium Urate. By EMIL WÖRNER (*Zeit. physiol. Chem.*, 1900, 29, 70—77).—The process recommended is a modification of Hopkins' method. The urine is treated with ammonium chloride, the precipitated ammonium urate washed with a saturated solution of ammonium sulphate, and then the nitrogen determined in the precipitate by Kjeldahl's method. Edmund's statement (*Abstr.*, 1895, ii, 237), that ammonium sulphate is a less ready precipitant of the urate than the chloride, is confirmed, in spite of what Folin (*Abstr.*, 1898, ii, 196) says to the contrary. The readiness with which the precipitation occurs with ammonium sulphate increases, however, with rise of temperature.

W. D. H.

The Inner Saponification Number. By WILHELM FAHRION (*Zeit. angew. Chem.*, 1899, 1221).—The "inner saponification number" is the figure showing the number of milligrams of potassium hydroxide required to neutralise the non-volatile and non-oxidised fatty acids from 1 gram of fat. The author regards Lewkowitsch's objection to this name and his proposal to call it the "saturation number" as unwarranted.

L. DE K.

Constancy in the Composition of Cow's Milk and Detection of its Adulterations. By H. TIMPE (*Chem. Zeit.*, 1899, 23, 1040—1043).—From the results of a large number of analyses, the author concludes that in genuine milk the relation between the proteids and the fat may be expressed by the equation $P = 2 + 0.35 F$.

If the proteids found by actual experiment do not reasonably agree with those obtained by calculation, the milk is either skimmed, watered, or affected both ways. Formulae are given to facilitate calculation. The question of watering may also be decided from the percentage of milk-sugar found; in fact, the process requires a complete and careful analysis.

L. DE K.

Effect of Milk Preservatives on Milk Fat. By BERNHARD SCHULZE (*Bied. Centr.*, 1899, 25, 858; from *Ber. Agri. Versuchs-Stat. Breslau*, 1896).—Small amounts of potassium chromate (0.1—0.2 per cent.) had no essential effect on the amount of milk-fat in 14 days. With more than 0.5 per cent. of chromate there was, however, a considerable reduction in the percentage of fat. Milk which is, perhaps, not

examined for a considerable time should therefore not be treated with uncontrolled quantities of chromate. Salicylic acid seems to be the best preservative.

N. H. J. M.

Estimation of Fatty Matter in Butter by Gerber's Process. By J. WERDER (*Chem. Zeit.*, 1899, 23, 1028).—Gerber's acid-butyrometric process gives unsatisfactory results, as a well-defined layer of liquid fat is rarely obtained, but by a slight modification of the method, satisfactory results may be obtained.

1 gram of the sample of butter is treated in the "Gerber butyrometer" (old pattern) with 18 c.c. of sulphuric acid of sp. gr. 1.5 and 1 c.c. of amyl alcohol, and the result multiplied by 1.094; the percentage of fat so found practically agrees with the results obtained by Soxhlet's process.

L. DE K.

Bechi and Halphen's Colour Reactions for the Identification of Cotton-seed Oil. By P. N. RAIKOW and N. TSCHERWENIWANOW (*Chem. Zeit.*, 1899, 23, 1025—1028).—The authors, after a lengthy investigation, conclude that the Bechi silver test is quite satisfactory if conducted according to the directions of the Italian Scientific Committee (in which a solution of colza oil in amyl alcohol is used).

The Halphen test, in its original form (heating the sample with sulphur, carbon disulphide, and amyl alcohol), is also an excellent test for the presence of cotton-seed oil in olive and similar oils.

L. DE K.

Macassar Oil. By J. J. A. WIJS (*Zeit. physikal. Chem.*, 1899, 31, 255—257).—The author has determined a number of physical and chemical constants for this oil, and gives a table comparing his values with those of other observers.

J. C. P.

Detection of Phytosterol and Cholesterol in Fats. By HANS KREIS and ERNST RUDIN (*Chem. Zeit.*, 1899, 23, 986).—The process recommended by Kreis and Wolf (*Abstr.*, 1898, ii, 343) not being found to be quite satisfactory, has now been modified by the authors as follows: 50 grams of the fat are saponified, as usual, with 125 c.c. of strong alcohol and 25 c.c. of 40 per cent. aqueous caustic potash. When the alcohol has evaporated, the soap is dissolved in 500 c.c. of boiling water, and decomposed by adding 120 c.c. of a 10 per cent. solution of calcium chloride. When cold, the precipitate is collected on a cotton cloth, and the lime-soap pressed dry, powdered, and covered in a closed flask with 100 c.c. of a mixture of equal parts of alcohol and ether. After an hour, the liquid is filtered, and the residue washed with another 50 c.c. of the ethereal mixture; the filtrate is then mixed with 3 c.c. of the aqueous potash and 20 grams of quartz-sand, and evaporated to complete dryness on the water-bath. The residue is extracted with ether in a Soxhlet's apparatus, the solvent evaporated, and the phytosterol, or cholesterol, recrystallised from alcohol.

L. DE K. 16

General and Physical Chemistry.

Rotatory Power of Active Valeric Acid. By PHILIPPE A. GUYE and EMILY ASTON (*Compt. rend.*, 1900, 130, 585—588).—The authors have determined the specific rotatory power of active valeric acid at various temperatures, with the following results:

1st specimen: $[\alpha]_D +11.27$ at 11° , $+10.84$ at 59.5° , $+9.0$ at 188° (vapourised).

2nd specimen: $[\alpha]_D +9.07$ at 16° , $+7.54$ at 99° , $+7.3$ at 188° (vapourised).

In dilute aqueous solution, the acid may be regarded as existing in the form of simple molecules; in a 1.2 per cent. solution, $[\alpha]_D +14.4$ at 18° , and in a 3.9 per cent. solution, $[\alpha]_D +14.6$ at 18° , the rotatory power of the liquid acid being $+12.02$ at 15° . When dissolved in ethylene dibromide, the acid is most probably polymerised; in a 1.27 per cent. solution, $[\alpha]_D +7.8$, in a 2.1 per cent. solution, $[\alpha]_D 9.65$, in an 11.91 per cent. solution, $[\alpha]_D +10.12$, the rotatory power of the liquid acid being $+11.27$ at the same temperature (18°).

The influence of temperature on the specific rotatory power of active valeric acid is not abnormal, and the difference between the acid and the alcohol in this respect is doubtless due to the relatively much smaller effect of temperature in dissociating the acid into simple molecules. It is evident that under ordinary conditions the acid is partially polymerised.

C. H. B.

Silver Germ or Subhaloid Theory. By RICHARD ABEGG (*Chem. Centr.*, 1900, i, 439—440; from *Arch. wiss. Phot.*, 1, 268—272).—An answer to Mercator's objections (*Arch. wiss. Phot.*, 1, 199) to the silver germ theory of the latent photographic image (*ibid.*, 15). Eder's observation (*Phot. Korresp.*, 1899, 233, 276), that collodion plates, even after treating with a very strong nitric acid sensitising bath, still exhibit a faint image on development, shows that a portion of the latent image is destroyed by the acid, and must therefore be due to silver germs. It is still doubtful, however, whether the layer of acid adhering to the plate is sufficient to destroy all the silver germs of the latent image, or whether the image obtained is not due to unattacked germs.

E. W. W.

The Nature of the Latent Image and the so-called Eder Test. By ROBERT LUTHER (*Chem. Centr.*, 1900, i, 440; from *Arch. wiss. Phot.*, 1, 272—274).—When silver powder is repeatedly shaken with fresh quantities of chlorine water, each portion of which contains 1/10th the amount of the chlorine required to convert the silver into chloride, the oxidation potential of the residual chlorine remains constant until just 50 per cent. of the chlorine equivalent to the silver is combined, whilst after this point the oxidation potential increases until the whole of the silver has been converted into chloride. Silver and bromine give similar results, hence the subhaloids, Ag_2Cl and

Ag_2Br , exist, and their formation marks a distinct phase in the action of the halogen on the metal. The oxidation potentials for the conversion of the subchloride and subbromide into the ordinary haloids are 1.15 and 1.45 respectively. When the latent image of a silver bromide plate is treated with a solution of potassium chromate containing hydrogen bromide sufficient to give an oxidation potential of 1.1, the latent image is not attacked, but it is completely destroyed by a solution of oxidation potential 1.2. The oxidation potential of the compound formed by the action of light must therefore be about 1.15, or identical with that of silver subbromide. Similar results were obtained in the case of silver chloride plates, hence, at least in the absence of gelatin, the latent image consists of subhaloids. When silver is placed on a dry plate without pressure, Eder's test fails, and no image is formed on development, but if silver powder, quartz, and silver subbromide are rubbed into a silver bromide gelatin plate, the plate, when developed, shows no change below the quartz, but is black below the silver, and is found to be still more strongly affected under the bromide.

E. W. W.

Electric Charge of the Deviable Rays of Radium. By P. CURIE and SKŁODOWSKA CURIE (*Compt. rend.*, 1900, 130, 647—650).—Those rays emitted by radium which are deviated by a magnetic field are charged with negative electricity, but to a less degree than cathode rays. Hence it may be concluded that the radiation of radium is due to the emission of particles of electrified matter. Röntgen rays are extremely feebly, if at all, charged.

N. L.

[Validity of Maxwell's Equations.] By P. S. WEDELL WEDELLSBORG (*Zeit. physikal. Chem.*, 1899, 29, 494) and ANTON SCHEYE (*ibid.*, 1900, 32, 145—149).—A continuation of the controversy regarding the validity of Maxwell's equations (see Abstr., 1898, ii, 61, 419.)

L. M. J.

Inversion of Hepta- and Hexa-hydrates of Zinc Sulphate in the Clark Cell. By H. T. BARNES (*J. Physical Chem.*, 1900, 4, 1—20).—The paper contains a more detailed account of the experiments made by the author in conjunction with Callendar on the change of E.M.F. of the Clark cell at a temperature about 39°. The E.M.F. of the cell was determined at various temperatures above 30° by comparison with another maintained at 15°; the experimental details are explained, and curves and tables are given showing the difference between the E.M.F. found and that calculated from the temperature coefficient between 15° and 30°. It is seen that, with ascending temperatures, the change took place at about 42°, and with descending temperatures at about 30°, the curves for the two branches cutting a little below 39°. The variations of E.M.F. with temperature between 0° and 30° in millivolts are given by the expression $E_t - E_{15} = -1.200(t - 15) - 0.0062(t - 15)^2$, and expressions for the two branches above 30° are given, the actual transition point being at 38.78°. The inversion point, as determined by solubility experiments, is 39.95°, but in the Clark cell this temperature must necessarily be lowered by the presence of the mercurous sulphate. The author also considers

that secondary change, due to decomposition of mercurous sulphate, takes place above 35° , as by maintaining a cell at 46° a further change in the E.M.F. was found to occur (Abstr., 1898, ii, 276).

L. M. J.

Potential of the Iodine Electrode. By FRIEDRICH W. KÜSTER and F. CROGINO (*Zeit. anorg. Chem.*, 1900, 23, 87—88).—The potential differences between a platinum electrode and various solutions of potassium iodide saturated with iodine have been determined. Solutions have also been used containing different quantities of iodine in a $1/8$ th normal solution of potassium iodide. The results are analogous to those obtained with metal electrodes.

J. C. P.

Potential of Silver in Solutions of its Mixed Halogen Salts. By FRIEDRICH W. KÜSTER and A. THIEL (*Zeit. anorg. Chem.*, 1900, 23, 25—27).—A preliminary note of work arising out of a previous research (Abstr., 1899, ii, 205). The potential between a silver electrode and a normal mixed solution of potassium chloride and bromide, the latter being in equilibrium with a mixed precipitate of silver chloride and bromide, changes gradually from -0.51 volt when there is no silver bromide in the precipitate and no potassium bromide in the solution, to -0.36 volt when there is no silver chloride in the precipitate and no potassium chloride in the solution.

J. C. P.

Three Additions to the Kohlrausch-Ostwald Conductivity Method. By J. LIVINGSTON R. MORGAN (*J. Amer. Chem. Soc.*, 1900, 22, 1—5, 26—28).—Owing to magnetisation of the spring of the contact breaker, the interruptor deteriorates, and the clear note of the telephone is lost. The author describes a form of contact breaker in which this is avoided, the wire conveying the current being attracted by an electro-magnet excited by a separate strong current, this attraction of the wire causing the interruption of the current. Resistances equal to 4, 9, or 19 times that of the metre bridge are so arranged that no readings may be necessary near the end of the bridge; and a double contact key is described, by which two points, about a centimetre apart, are readily obtained, for which the sound intensity is equal, the mid-point giving the zero.

L. M. J.

Influence of Temperature on the Electrical Conductivity of Dilute Amalgams, and the Solubility of Metals in Mercury. By ABSALON LARSEN (*Ann. Phys.*, 1900, [iv], 1, 123—131).—The relative conductivity L_t of liquid amalgams of lead, zinc, cadmium, tin, and bismuth, that is, the conductivity compared with that of mercury at the same temperature, increases proportionally with the temperature, the absolute increase depending on the concentration of the particular amalgam; if $L_t = 1 + \delta_t$, then $\delta_t = \delta_{20}[1 + \alpha(t - 20)]$, the coefficient α varying from 0.0004 for cadmium and zinc amalgams to 0.002 for bismuth amalgams. It appears that in dilute liquid amalgams the dissolved metal is dissociated, and that the degree of dissociation increases both with falling concentration and with rising temperature.

The curve connecting relative conductivity and concentration of the

amalgam shows a break where the limit of solubility is reached. The relative conductivity, and therefore the concentration, of amalgams saturated at various temperatures increases nearly proportionally with the temperature. J. C. P.

Stannic Chloride in Aqueous Solution. By WL. VON KOWALEWSKY (*Zeit. anorg. Chem.*, 1900, 23, 1—24).—The hydrolysis of stannic chloride solutions, according to the equation $\text{SnCl}_4 + 4\text{H}_2\text{O} = \text{Sn}(\text{OH})_4 + 4\text{HCl}$, has been traced by determinations of their conductivity, which increases as time goes on. A point of equilibrium is ultimately reached before hydrolysis is complete, and the effect of a rise of temperature on the equilibrium is to diminish the extent of hydrolysis: the equilibrium in question can further be reached from both sides. Excess

of Cl^- ions hinders the hydrolysis, and the conductivity of a mixed solution of stannic chloride and hydrochloric acid may be less than that of the hydrochloric acid solution alone, owing, doubtless, to the formation of a complex salt. Investigation of the freezing points of the solutions, and their influence on the hydrolysis of methyl acetate, leads to the conclusion that the non-electrolytes present interfere considerably with the dissociation of the hydrochloric acid. The author has been unable to determine definitely the concentrations of the various molecules present in solution at the point of equilibrium.

When a solution of stannic chloride is added to a saturated solution of sodium chloride, and the mixed solution is diluted with water, the specific conductivity is found to increase to a certain point with the dilution. J. C. P.

Electrochemical Properties of Silver Fluoride and of Fluorine. By RICHARD ABEGG and CL. IMMERWAHR (*Zeit. physikal. Chem.*, 1900, 32, 142—144).—The conductivity of solutions of silver fluoride at dilutions of from about $N/1$ to $N/200$ was determined, and from the values the dissociation was calculated; at the higher concentrations, this is approximately equal to that of silver nitrate. In the more dilute solutions, high values for the conductivity indicate partial hydrolysis of the salt. The decomposition tension of fluorine exceeds that of chlorine by about 0.45 volt, and it is noticeable that an approximately equal difference separates the other halogens. An increase of solubility of silver oxide is occasioned by addition of silver fluoride, this being probably due to the formation of complex ions. L. M. J.

Electrochemical Equivalent of Copper and Silver. By THEODORE W. RICHARDS, EDWARD COLLINS, and GEORGE W. HEIMROD (*Zeit. physikal. Chem.*, 1900, 32, 321—347).—An examination of the irregularities of the copper voltameter leads in general to results agreeing with those of Foerster and Seidel (compare Abstr., 1897, ii, 241; 1898, ii, 10). Copper plates become lighter in acidified copper sulphate solutions, owing to the solution of the copper and the simultaneous formation of cuprous sulphate: this action increases as the temperature rises. Copper plates in neutral copper sulphate solutions become heavier by the deposition of cuprous oxide, formed by the hydrolysis of cuprous sulphate. With regard to the copper

voltameter, the authors point out that (1) the solution must be as cold as possible; (2) the solution must be acid to prevent hydrolysis; (3) the solution must be as dilute as possible, whilst the liberation of hydrogen is avoided; (4) air must be carefully excluded. Foerster and Seidel's plan of saturating the solution from the beginning with cuprous ions is criticised as giving too heavy a deposit of copper: this view is borne out by experiment. Comparison of the copper deficit in the copper voltameter with the current density at the cathode shows: (1) that a high current density gives far too low a deposit of copper, owing doubtless to the separation of hydrogen; (2) that the loss of copper due to solution in the copper sulphate is approximately proportional to the extent of the electrode surface. By taking then the actual weight of copper deposited in any given case, and extrapolating to the electrode surface zero, a value is obtained which will correspond closely with the amount of electricity that has passed through the cell. A series of experiments, treated in this way and based on a comparison of the copper voltameter with the ordinary silver voltameter, gave the mean value 63.563 for the atomic weight of copper, distinctly less than the value 63.604, obtained by purely chemical methods.

As regards the silver voltameter, it appears from the work of numerous observers that some substance, connected with or proceeding from, the anode, causes too large a deposit of silver at the cathode. Experiment having shown that the cathode deposit was not contaminated by mother liquor, the authors adopted the device of inserting a porous cell between the anode and the cathode. This arrangement of the silver voltameter gives, under similar conditions, a smaller deposit of silver than any other of the forms used. The quantity of silver deposit is less affected by change of temperature in this porous cell form of the voltameter than in Lord Rayleigh's form, and the authors consider their results the more correct. When the necessary correction is made on the ordinary silver voltameter, the atomic weight of copper, deduced from the experiments described above, now lies between 63.598 and 63.615. The electrochemical equivalent of silver is corrected to 0.0011172 gram per amp. sec., and that of copper to 0.0003292 gram per amp. sec.

J. C. P.

Electrochemical Equivalent of Carbon. By H. C. PEASE (*J. Physical Chem.*, 1900, 38—40).—The electrochemical equivalent of carbon was found by determining the loss of weight of a carbon anode in fused caustic potash, iron being used for the cathode. The results obtained were 3.15, 3.66, 3.40, 3.23 and 3.14, which, when a slight loss due to disintegration is allowed for, indicated the electrochemical equivalent of 3 (Abstr., 1893, ii, 14).

L. M. J.

The Electrical Reduction of Non-electrolytes. By FRITZ HABER (*Zeit. physikal. Chem.*, 1900, 32, 193—270).—For the electrolytic reduction of nitrobenzene in alkaline solution, the equation is deduced: $\epsilon = 0.0436 \log(I/C_{NO_2}) - \text{const.}$, where ϵ is the fall of potential at the cathode, I the current strength, and C_{NO_2} the concentration of the nitrobenzene in the cathode solution. This equation, which holds for ordinary temperatures, is based on Nernst's formula for the fall of

potential at an electrode, on the law of mass action, and on the conception of the cathode as a solid solution of the reducing agent. In three series of experiments, where the fall of potential, the concentration of the nitrobenzene, and the current strength respectively were kept constant, the equation just given was found to agree with the results of observation. A plain platinum cathode was used in almost all cases. The equation $\epsilon = 0.0436 \log(10/C_{NO_2}) - \text{const.}$, represents the results satisfactorily both with a platinised platinum cathode in alkaline solution and with a plain platinum cathode in acid solution.

J. C. P.

Recent Researches on Magnetic Susceptibility. By JOH. KÖNIGSBERGER (*Ann. Phys.*, 1900, [iv], 1, 175—177).—A criticism of some of Meyer's results and conclusions (this vol., ii, 7). The author holds that compounds of twodiamagnetic elements may be paramagnetic. In the case of certain compounds for which Meyer observed no influence of the field strength, such an influence has been detected.

J. C. P.

Thermochemical Law of Maximum Work. By ALBERT REYCHLER (*Chem. Centr.*, 1900, i, 162; from *Rev. Univ. Bruxelles*, 1899, 5, 5—16).—The author shows that, under certain conditions, Berthelot's law of maximum work can be looked on as a consequence of the fundamental laws of thermodynamics. Superheated systems are those which are in equilibrium at a lower temperature, supercooled those which were in equilibrium at a higher temperature; the former are endothermic, the latter exothermic. Non-reversible reactions take place in supercooled systems, and are always exothermic; reversible reactions are only exothermic when the temperature is below that of equilibrium. Berthelot's law should be interpreted as meaning that heat is developed by all spontaneous changes in systems which are below their temperature of equilibrium. Supercooled systems may be due to the fact that during the process of cooling, external causes prevented equilibrium being established at each temperature; thus sulphur and free oxygen exist together on the earth. Exothermic, and therefore supercooled, systems may also arise through access of energy by radiation, although the temperature of equilibrium did not prevail at the point of formation.

J. C. P.

Tubular Furnace giving Fixed Temperatures, adjustable at Will. By ARMAND GAUTIER (*Compt. rend.*, 1900, 130, 628—633).—A detailed description of a form of gas furnace by means of which any desired temperature between 150° and 1300° may be maintained constant within a few degrees for several hours. The apparatus consists essentially of an iron tube containing the glass or porcelain tube to be heated and enclosed in a fire-clay casing, between which and the iron tube pass the flames of two rows of Bunsen burners supplied with gas at a carefully regulated pressure.

N. L.

Measurement of Low Temperatures. II. By ALBERT LADENBURG and C. KRÜGEL (*Ber.*, 1900, 33, 637—638. Compare Abstr., 1899, ii, 545).—More careful measurements than those already carried out (*loc. cit.*) lead to the following revised data. *Boiling points:*

Oxygen, -182.2° (745.0 mm.); nitric oxide, -142.8° (757.2 mm.); hydrogen chloride, -83.1° (755.4 mm.); hydrogen bromide, -68.1° (755.4 mm.); hydrogen iodide, -36.7° (751.7 mm.); hydrogen sulphide, -60.4° (755.2 mm.); methane, -162° (751.0 mm.); ethane, -84.1° (749.0 mm.); propylene, -48.2° (749.0 mm.); trimethylene, about -34° (749.0 mm.); acetylene, -82.4° .

Melting points: Nitric oxide, -150.5° ; ammonia, -75.5° ; hydrogen chloride, -111.3° ; hydrogen bromide, -86.13° ; hydrogen iodide, -51.3° ; hydrogen sulphide, -82.9° ; ethane, -172.1° ; trimethylene, -126.6° ; toluene, -93.2° ; ethylbenzene, -93.2° ; mesitylene about -57.5° ; cymene, -73.5° ; methyl chloride, -102.9° ; ethyl bromide, -115.8° ; ethyl iodide, -110.6° to -113.1° ; methyl alcohol, -93.9° ; ethyl alcohol, -111.8° ; ethyl ether, -113.1° ; acetaldehyde, -120.6° ; acetone, -93.9° ; ethylene glycol, -15.6° ; methyl formate, -100.4° ; ethyl acetate, -82.4° ; ethylamine, -83.8° . T. H. P.

Specific Heat of Metals at Low Temperatures. By U. BEHN (*Ann. Phys. Chem.*, 1898, [ii], 66, 237—244).—Small cylinders of aluminium, iron, nickel, copper, lead, palladium, iridium, and platinum, contained in test-tubes, were cooled in a bath of liquid air or a mixture of solid carbon dioxide and alcohol; they were then introduced into a quantity of water in a calorimeter, and the specific heat calculated in the usual way. In all cases examined, the specific heat diminishes as the temperature falls, the decrease being greatest for the metals with large specific heat. The mean atomic heats of copper, nickel, iron, and aluminium, in the interval -79° to -186° , lie between the values 4.0 and 4.5. J. C. P.

Specific Heat of Metals, Graphite, and a few Alloys at Low Temperatures. By U. BEHN (*Ann. Phys.*, 1900, [iv], 1, 257—269).—The specific heats of antimony, tin, cadmium, silver, zinc, magnesium, and graphite have been determined by the method and at the temperatures formerly employed (see preceding abstract). In these, as in the earlier cases, the specific heat diminishes with falling temperature; the smaller the atomic weight of the metal, and the lower the temperature reached, the greater is the decrease of the specific heat. The mean atomic heat of graphite for the interval -79° to -186° is only 0.9.

From the mean specific heats obtained by experiment, the true specific heat c at any particular temperature t may be calculated, with the help of the relation $c = A + Bt + Ct^2$, where A , B , and C are constants. The atomic heat of graphite at -186° is thus calculated to be 0.486. Of the curves showing the relation between true specific heat and temperature, those for lead, antimony, tin, and graphite are nearly straight lines. The variation of specific heat with temperature is seen from these curves to be greatest in the case of elements with a small atomic weight and a small atomic volume.

For brass and a few alloys of lead and tin, the specific heat has approximately the same value as that calculated from the specific heats of the component metals. J. C. P.

Method for the Determination of the Melting Point. By MITSURU KUHARA and MASUMI CHIKASHIGÉ (*Chem. News*, 1899, 80, 270—271).—Instead of being placed in a capillary tube, a thin layer of the substance is held between two pieces of thin glass (microscope cover glasses) and suspended by a platinum foil support in a test-tube, which is placed in the sulphuric acid bath. D. A. L.

Regularities in Melting Points. By THEODOR SALZER (*J. pr. Chem.*, 1900, [ii], 61, 165—168).—The regular fall of melting point in the series of alkylsuccinic acids has been confirmed by Bone and Sprankling's determination of the melting point of methylsuccinic acid (*Trans.*, 1899, 75, 839).

In the malonic acid series, a similar regularity cannot be observed, since the decomposition points are very low. Thus malonic acid and methylethylmalonic acid were found to decompose at the melting point, and isopropylmalonic acid at 120°, but dimethylmalonic acid is stable at the melting point.

Further regularities occur in the melting points of the following series: (1) Acetanilide (112°), propionylanilide (105°), butyrylanilide (90°); (2) methyl, ethyl, and propyl *p*-hydroxybenzoates (131°, 112·5° or 116°, and 96°); (3) the aurichlorides of morpholine, methylmorpholine, and ethylmorpholine (240°, 183°, and 125°); (4) α -methylpiperidine, α -ethylpiperidine, and α -propylpiperidine (167°, 121°, and 85°); (5) β -methylpiperidine, β -ethylpiperidine, and β -propylpiperidine (139°, 112° or 108°, and 98° or 93°). T. M. L.

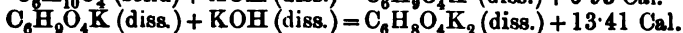
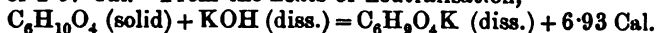
Heat of Sublimation of Carbon Dioxide, and Heat of Vaporisation of Air. By U. BEHN (*Ann. Phys.*, 1900, [iv], 1, 270—274).—The mean specific heat of a metal being known for the interval 18° to -183° (see preceding page), it is possible, by dropping a cylinder of the metal into liquid air and measuring the quantity of vapour formed, to calculate the heat of vaporisation of air; the value actually found as a mean of two experiments was 50·8 Cal. An analogous process for solid carbon dioxide in absolute alcohol gave for the heat of sublimation of carbon dioxide the value 142·4 Cal., the two separate experimental results being 142·0 and 142·8 Cal.

When these values for r , the heat of sublimation or vaporisation, are introduced in the equation $Jr = T.s.dP/dT$, where J is the mechanical equivalent of heat, T the absolute temperature, s the specific volume of the vapour, and dP/dT the temperature coefficient of the vapour pressure, the specific volume of gaseous air at -183° is calculated to be 358, and that of gaseous carbon dioxide at -79° to be 423. J. C. P.

Heat of Neutralisation and Electrolytic Dissociation. By A. THIEL (*J. pr. Chem.*, 1900, [ii], 61, 141—150).—A criticism of Vaubel's conclusions as to the significance of the thermochemical data for the heat of neutralisation of acids and bases (*Abstr.*, 1899, ii, 727). T. M. L.

Thermochemistry of Normal Adipic Acid. By GUSTAVE MASSOL (*Bull. Soc. Chim.*, 1900, [iii], 23, 100—101).—Anhydrous

normal adipic acid melts at 146.5° (Arppe gives 148° , and Bromeis 145°); its solubility in water (1 per cent. at 15°) is too small to allow its heat of dissolution to be determined. Normal potassium adipate becomes anhydrous at 100° , and dissolves in water with the development of 2.67 Cal. From the heats of neutralisation,



it is calculated that the heat of formation of normal potassium adipate is 45.45 Cal., all the substances concerned being in the solid state. Adipic acid is therefore perfectly comparable with its homologues, succinic, glutaric, and suberic acids, for which the corresponding figures are 46.50 Cal., 44.23 Cal., and 44.76 Cal. respectively (Abstr., 1899, ii, 80).

N. L.

Isomerism of Thiocyanic Derivatives. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1900, 130, 441—447).—A thermochemical study of the isomeric thiocyanates and thiocarbimides. The following constants are recorded :

	Heats of combustion.		Heat of formation.	Heat of transformation of normal-into iso-salt.
	Constant volume.	Constant pressure.		
Methyl thiocyanate.....	452.1 Cal.	453.1 Cal.	-19.9 Cal.	8 to 9 Cal.
Methylthiocarbimide (solid)	441.6 "	442.6 "	-9.4 "	—
Ethyl thiocyanate.....	612.5 "	613.8 "	-17.25 "	9.6 "
Ethylthiocarbimide	602.8 "	604.1 "	-7.6 "	—
Phenylthiocarbimide	1019.0 "	1020.3 "	-46.5 "	—
Allylthiocarbimide.....	731.2 "	732.6 "	-41.8 "	—
Thiosinamine.....	790.4 "	781.8 "	-6.48 "	—

G. T. M.

Meconin, Opianic and Hemipinic Acids. By ÉMILE LEROY (*Compt. rend.*, 1900, 130, 508—510).—The heat of combustion of meconin at constant volume is 1136.2 Cal., and, at constant pressure, 1136.5 Cal., its heat of formation being 151.6 Cal.; this substance, considered as a dimethoxyphthalide, is comparable with phthalide; their heats of combustion differ by 251.1 Cal., and a similar difference exists between those of benzene and its methoxy-derivatives. When meconin is oxidised to opianic acid, the heat developed is 46.1 Cal., the mean value for the heat of oxidation of an alcohol to an aldehyde is greater than 50 Cal.; the discrepancy is probably due to the slight thermal change which accompanies the dehydration of the hydroxy-acid, of which meconin is the inner anhydride. The heats of combustion, formation, and dissolution of opianic acid are 1090.4, 197.7, and -6.8 Cal. respectively; the heat of neutralisation of the dissolved acid by a solution of potassium hydroxide is 15.53 Cal. Opianic acid almost completely displaces acetic acid, the heat developed being 2.0 Cal., the value calculated for complete displacement being 2.2 Cal. The heat of dissolution of crystallised potassium opianate, $\text{C}_{10}\text{H}_9\text{KO}_5 \cdot 2\frac{1}{2}\text{H}_2\text{O}$, is -4.88 Cal., whilst that of the salt dehydrated at low temperatures is 4.30 Cal.; when dried at higher temperatures, the heat developed is only 1.20 Cal.; the heat of formation of the solid salt is 18.44 Cal. The two isomeric methyl opianates have

practically the same heats of combustion and formation, the mean values of these constants being 1262 Cal. and -189.7 Cal. respectively. The heat of combustion of hemipinic acid is 1024.7 Cal., and its heat of formation 263.5 Cal.

The difference between the heats of combustion of hemipinic and phthalic acids is 253 Cal., and corresponds with the thermal change produced by the introduction of two methoxyl groups into the molecule of the latter compound; this supports the view that the former acid is a dimethoxyphthalic acid.

The heat of oxidation of opianic acid to hemipinic acid agrees closely with the normal value of the thermal change produced by the oxidation of an aldehyde to an acid. The heat of oxidation of meconin to hemipinic acid is 111.0 Cal., whilst that of phthalide to phthalic acid is 113.8 Cal. G. T. M.

Freezing Point Method in Dilute Solutions, and the Theory of Solutions. By MEYER WILDERMANN (*Zeit. physikal. Chem.*, 1900, 32, 288—302).—A review of recent work on this subject, and a criticism in particular of Dieterici's views and results (*Abstr.*, 1898, ii, 207; 1899, ii, 403). J. C. P.

Abnormal Depressions of the Freezing Point produced by Chlorides and Bromides of the Alkaline Earths. By HARRY C. JONES and VICTOR J. CHAMBERS (*Amer. Chem. J.*, 1900, 23, 89—105).—The depression of the freezing point produced by the chlorides and bromides of calcium, strontium, barium, and magnesium in aqueous solutions of various concentrations has been measured; unlike the alkali halogen salts, which produce a continually increasing molecular depression with increase of dilution, the salts of the alkaline earths give rise initially to a *decrease* of the depression, which falls to a minimum at a concentration between $N/10$ and $N/5$, but subsequently increases in the ordinary manner with increasing dilution. With cadmium chloride or bromide, however, normal results are obtained, the molecular depression increasing regularly with increase of dilution. A comparison of the electrical conductivities of the salts named, in solutions of varying concentration, shows no irregularity in the region where the molecular depression is a minimum. Since the halogen salts of the alkaline earths are very hygroscopic, it is suggested tentatively, as a possible explanation of their abnormal behaviour, that in concentrated solutions they combine with a portion of the water used as solvent, forming complex hydrates, which undergo dissociation on increasing the dilution. The conductivity results, which show that marked dissociation occurs in the concentrated solutions, cannot, however, be readily reconciled with this view unless it is assumed that a certain number of the molecules are ionised by the water in combination with them just as salts are probably dissociated by their water of crystallisation. W. A. D.

Cryoscopic Observations. By KARL AUWERS [and, in part, W. BAERTSCH, F. H. BETTERIDGE, MAX DOHRN, and H. M. SMITH]. (*Zeit. physikal. Chem.*, 1900, 32, 39—62).—Various derivatives of *p*-cresol which are *o*-hydroxy-ketones were found to be cryoscopically

normal in naphthalene solution; *p*-nitrobenzoyl-*p*-cresol, however, yields a curve which falls with increasing concentration, no explanation of this anomaly being assigned. *p*-Hydroxy-ketones of the type of *p*-hydroxyacetophenone were found to yield abnormal curves, the abnormality increasing with molecular weight, a result which differs from that usually obtained in such cases. Methyl *p*-hydroxybenzoate is abnormal, but the halogen derivatives ($\text{OH} : \text{Cl} = 1 : 2$) are all almost normal, the halogens having approximately equal normalising influence. A number of derivatives of *p*-hydroxybenzaldehyde were found to be abnormal, but to a less extent than the parent substance. Amongst the diphenols and their monomethoxy-derivatives, resorcinol was found to be abnormal, guaiacol normal, and the remainder slightly abnormal. Dimethyl oxalate was also employed as a solvent, and it was found that compounds cryoscopically abnormal in naphthalene give almost normal results, so that the solvent is only weakly abnormalising. *p*-Azoxyanisole was also used as a solvent, all the compounds investigated giving normal curves; the cryoscopic constant of this solvent is, however, somewhat uncertain; Schenck adopted the value 750, whilst the author obtains a mean value of 545, with, however, very wide limits, so that before the compound is useful cryoscopically, this uncertainty must be removed (Abstr., 1899, ii, 637). L. M. J.

Corresponding States. By KIRSTINE MEYER née BJERRUM (*Zeit. physikal. Chem.*, 1900, 32, 1—38).—Although van der Waals's expression can be only regarded as an approximation, nevertheless the important law of corresponding states may be valid, and the paper contains an elaborate investigation of known data in order to determine whether this is the case or not. If a law of corresponding states holds, then, assuming the critical states as corresponding for any pair of compounds, at corresponding temperatures T and T' the expression $\log.(T_c - T) - \log.(T'_c - T')$ is constant and independent of pressure, whilst a similar expression $\log.(P_c - P) - \log.(P'_c - P')$ is independent of temperature. Curves for $\log.(T_c - T)$ against $\log.(P_c - P)$ for the two compounds should therefore be mere displacement be superposable, and this is found to be the case, whilst, further, since $\log.(P_c - P) - \log.(P'_c - P') = \log.P_c - \log.P'_c$, it follows that equal fractions of the critical pressure are corresponding pressures. This, however, does not hold for temperature, that is corresponding temperatures, at which the vapour pressures are equal fractions of the critical pressure, are not always equal fractions of the critical temperatures, and for comparison temperatures must be measured from different zero values, usually a few degrees above 273° . This is also the case for volumes, the ratio of corresponding volumes not being that of the critical volumes, but equal to a ratio q/q' , where q' is usually slightly greater than the critical volume. The law of corresponding states hence does actually obtain, but temperatures and volumes must be measured from different null points. The validity of the deductions is also proved by the comparison of the found and calculated isothermals of isopentane, hexane, ether, and carbon dioxide. Water and the alcohols form exceptions to these deductions, and this is probably to be ascribed to molecular association. L. M. J.

Absolute Molecular Volumes. By CATO M. GULDBERG (*Zeit. physikal. Chem.*, 1900, 32, 116—126).—By extreme compression of a liquid, a value may be assumed to be finally reached which is the absolute volume of the molecules, and is independent of temperature; whilst, similarly, the same value, independent of pressure, is reached by cooling to the absolute zero. Assuming the validity of the expression $p/RT = 1/(v - v_0) - \alpha$, then the value for v_0/v may be obtained by comparison of the volumes at either two temperatures or two pressures. These, however, involve the unknown constant, α , but by neglecting the term in which it occurs, the ratios are in one case too great, and in the other too small, and the values, which do not greatly differ, are given for a number of different compounds, the compressibility data being obtained from Amagat's results. The author has also given an empirical expansion law, which may be expressed as $a = a_0/\sqrt{1-t}$, where t is the ratio of the absolute temperature to a certain temperature T , which varies for different liquids, but is for many equal to the critical temperature. De Heen has also given the expression $a = a_0/(1 - \frac{2}{3}a_0T)$, and from each of these expressions v_0/v is calculable. From these, the values v_0 are derived, and it is seen that the numbers agree well with the previous values. The absolute molecular volumes and densities are so calculated and given for about 80 liquids. The mean value of the ratio of the critical volume to the absolute molecular volume is found to be 3.75. This absolute molecular volume is, however, not the sum of the atomic volumes, being dependent on structure; thus carbon, which has in the diamond an atomic volume of 3.4, has in organic liquids an atomic volume of 7.2. The molecular volumes so obtained may be approximately expressed by assuming C = O = N = 1; H = $\frac{1}{2}$; Cl = P = As = S = Si = 2.5; Br = 3; I = 3.75, the unit varying in different classes of compound between 7.1 and 7.9, and being greatest for unsaturated compounds. L. M. J.

Development and Application of a General Equation for Free Energy and Physico-chemical Equilibrium. By GILBERT NEWTON LEWIS (*Zeit. physikal. Chem.*, 1900, 32, 364—400).—A theoretical paper not suitable for abstraction. J. C. P.

Chemical Affinity. By WILHELM VAUBEL (*Chem. Zeit.*, 1900, 24, 35—36).—The author regards chemical affinity as made up of two components—gravito-affinity and electro-affinity. The part played by each of these factors is illustrated by several numerical examples, based on the author's previous papers (*Abstr.*, 1898, ii, 206 and 503; 1899, ii, 727). J. C. P.

Diazotisation and the Affinity Constants of Nitrous Acid. By M. SCHÜMMANN (*Ber.*, 1900, 33, 527—533).—The author has studied the velocity of the change represented by the equation $R \cdot NH_2Cl + HNO_2 \rightarrow R \cdot N_2Cl + 2H_2O$, by observing the fall of electrical conductivity in aqueous solution due to the transformation of the original dissociated acid system into the neutral, non-dissociating diazonium chloride; this method is possible, because all diazonium chlorides show practically the same conductivity in solution, and is superior to that employed by Hantzsch and Schümann (*Abstr.*, 1899, ii, 549), in that its rapidity

enables the first phases of the process to be accurately observed. The conclusion finally arrived at is that, in presence of an excess of acid, and in absence of secondary decomposition, "all aromatic amines are diazotised at approximately the same speed."

The experiments were carried out at 20°, by adding an *N*/500 solution of sodium nitrite to an *N*/500 solution of the hydrochloride of the base containing 1 mol. of hydrochloric acid. With *p*-anisidine and *p*-toluidine, the conductivity falls regularly, until a constant final value is reached after 2 hours; with aniline, *o*-toluidine, and ψ -cumidine, however, the minimum value, which is reached after about 2 hours, does not remain constant, but subsequently increases, owing to the secondary change, $R \cdot N_2Cl + H_2O = R \cdot OH + HCl + N_2$, occurring. In some cases, the formation of a diazoamino-compound introduces a similar disturbing influence; with *p*-bromoaniline, this factor produces little effect (compare Hantzsch and Schümann, *loc. cit.*), but with α - and β -naphthylamine, considerable quantities of diazoamino-compounds are formed in the first few minutes.

The author has also determined the affinity-constant of nitrous acid by measuring the conductivity of aqueous solutions of carefully purified sodium nitrite; for $NaNO_2$ at 25°, $\mu_\infty = 115.5$, and hence for HNO_2 at 25°, $\mu_\infty = 391.5$, and therefore $K = 0.045$. This value indicates that in the diazotisation process a considerable repression of the hydrolytic dissociation of the salt of the aromatic base must be caused by the nitrous acid; hence it is impossible to calculate the conductivity of the system additively from that of its components. W. A. D.

Chemical Equilibrium in a System of Four Gases. By H. PÉLABON (*Compt. rend.*, 1900, 130, 576—579).—The action of hydrogen on mercury selenide above 500° provides a case of four gaseous substances which, at a given temperature, are in chemical equilibrium; and the author shows that through a fairly wide range of pressure, and even in presence of excess of mercury, the partial pressures observed agree with those deduced from mechanical and thermochemical principles. C. H. B.

Relations between Ammonia and Salts in Aqueous Solution. By DMITRI P. KONOWALOFF (*J. Russ. Phys. Chem. Soc.*, 1899, 31, 910—927).—The relations between the strength of an aqueous ammonia solution and the pressure exerted by the ammonia in the solution have been determined at 59.96°. In the following table, n represents the number of gram-mols. of ammonia per litre, and P the partial pressure in mm. of mercury, due to the ammonia dissolved:

n	3.098	1.549	1.239	1.033	0.7745	0.6196
P_1	202.0	94.01	74.42	61.4	45.66	36.39
P_1/n	65.3	60.7	60.0	59.4	58.9	58.7

The presence of dissolved salts causes a diminution in the value of P_1 and for solutions containing less than about 1.5 gram-mols. of ammonia per litre (for which Henry's law is approximately true), this diminution is expressed by the following formula: $P = P_1(n - k.m)$, where P_1 represents the pressure of the ammonia in pure aqueous solution, P the pressure of the dissolved salt, n and m the number of

gram-mols. of ammonia and salt respectively in a litre of the solution, and k a constant. For silver nitrate, $k=2$, whilst for cadmium nitrate, zinc nitrate, nickel chloride, copper nitrate, copper chloride, coppersulphate, and copper acetate, k approximates more or less closely to the value 4. The more stable a solution is towards water, so much the more nearly do the values of k approach 4, the deviations from this number being greatest for those solutions which most readily give a precipitate on the addition of water. These facts are explained as due to the formation in solution of compounds $MX_2 \cdot 2NH_3$ (in the case of silver nitrate), or $MX_2 \cdot 4NH_3$ (for the salts of dibasic acids). Support is given to this hypothesis by the fact that increasing quantities of copper sulphate, when dissolved in aqueous ammonia, cause increasing elevations of the freezing-point, the magnitudes of the elevations being the same as would be produced if the compound $CuSO_4 \cdot 4NH_3$ were formed in the solution.

The colour of aqueous salt solutions is regarded as due to the existence of definite hydrates in the solutions, the different colours obtained in the presence of ammonia being caused by the formation of compounds of the salt with ammonia analogous to the hydrates. The change in electrical conductivity of a solution of ammonia on adding copper salts and that produced in a nickel sulphate solution by the addition of ammonia, are also explained by the formation of such compounds.

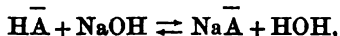
When ammonia combines with a salt, it causes a large increase in its electrical conductivity, whilst the replacement of the combined ammonia by water is accompanied by comparatively small changes in the conductivity. Thus luteocobaltic bromide, $CoBr_3 \cdot 6NH_3$, at a dilution of 500 litres, has the molecular conductivity, 401.6; $CoBr_3 \cdot 5NH_3 \cdot H_2O$ gives the value 390.3; $CoBr_3 \cdot 4NH_3 \cdot 2H_2O$, 379.8; $CoBr_3 \cdot 5NH_3$, 244.7; and $CoBr_3 \cdot 4NH_3$, about 190.6. T. H. P.

Equilibrium in Systems containing an Alkali Salt, Water, and Alcohol. By B. R. DE BRUYN (*Zeit. physikal. Chem.*, 1900, 32, 63—115).—The following systems were examined, water, ethyl alcohol, and (1) ammonium sulphate, (2) potassium carbonate, (3) sodium sulphate, and water, methyl alcohol, potassium carbonate. These differ from the systems examined by Schreinemakers, inasmuch as no pair forms two liquid phases. The systems containing the sulphates were most fully investigated, and for these spacial diagrams are given. In the system, ammonium sulphate—alcohol—water, a lower critical point occurs, about 8° , below which no separation into liquid phases can occur. Increase of temperature causes an increase of solubility in dilute alcohol, and the binodal curve indicates that for a high percentage of alcohol, cooling of a homogeneous solution causes a separation into two layers, whilst for solutions of low percentage the reverse obtains. The system, potassium carbonate—water—ethyl alcohol, gave no critical point between 75° and -18° ; as in the previous case, in systems of small alcohol content, warming causes a separation into two layers, and at certain compositions further increase of temperature again produces homogeneity. At all temperatures, potassium carbonate has a much greater effect than ammonium

sulphate in this respect. The hydrates were found to have the composition $K_2CO_3 \cdot 3H_2O$ and $K_2CO_3 \cdot 2H_2O$ respectively. In the system with methyl alcohol, a lower critical point of -35° was found, and at all temperatures in the presence of the solid hydrated carbonate, methyl alcohol and water are more miscible than water and ethyl alcohol. In systems of sodium sulphate—water—ethyl alcohol, above 32.5° , the anhydrous is the only solid phase; below this temperature, either the anhydrous salt or the decahydrate may occur; solutions in equilibrium with the heptahydrate are not stable. The solubility of the hydrates in dilute alcohol increases with temperature, that of the anhydrous salt decreases. Systems with two layers were obtained, but are unstable below 32.5° , and at 25° speedily deposit crystals of the hydrate with the formation of but one liquid phase. In this system, the complete spacial diagram between 0° and 45° is given.

L. M. J.

A Case of Chemical Equilibrium suitable for Demonstration. By PAUL DUDEN (*Ber.*, 1900, 33, 483—484).—Benzenesulphoncamphylamide is suspended in an excess of 10 per cent. sodium hydroxide solution, and, in the course of half a minute, is converted almost completely into the insoluble sodium salt; on adding ether, almost the whole of the sulphonamide is regenerated. In this way, it is easy to demonstrate the fact that in the equation



the equilibrium passes over almost completely to the right or to the left when the sodium salt or the acid is removed from the liquid phase in which interaction takes place. Benzenesulphoncamphenamide can also be used with a 6—7 per cent. solution of sodium hydroxide.

T. M. L.

Solubility of Carbon Dioxide in Alcohol between -67° and $+45^\circ$. Invasion and Evasion Coefficients at 0° . By CHRISTIAN BOHR (*Ann. Phys.*, 1900, [iv], 1, 244—256. Compare *Abstr.*, 1898, ii, 211, and 1899, ii, 641).—Two methods have been employed, one consisting in saturating the alcohol with carbon dioxide, and subsequently determining the quantity of gas absorbed, the other being an ordinary absorption method, and used at temperatures below 0° . The formula $\alpha(T-n) = K$ (*Abstr.*, 1898, ii, 211) is found applicable, the variation of n between -12° and 36° being very small. The values of α obtained at ordinary temperatures agree well with those of Carius; at 0° , α has the value 4.3, and as the temperature falls, it increases to about 44 at -67° . At the lowest temperatures, however, the absorption of gas causes considerable alteration of volume, and there is a little uncertainty about the extent of the correction to be applied.

The quantity δ , given by the equation $\delta = (\log x_0 - \log x) / t \cdot \log e$ (*Abstr.*, 1899, ii, 641), is satisfactorily constant, and the evasion coefficient at 0° is thence calculated to be 0.524. From the relation $\gamma = \alpha\beta$, where α is the absorption coefficient, β the evasion coefficient, and γ the invasion coefficient, γ is calculated to have the value 2.375

at 0°; direct experiment gave the value 2.459. The following table gives the various coefficients for water and alcohol:

	β	γ	α
Water	0.077	0.132	1.713
Alcohol	0.524	2.375	4.532

J. C. P.

Relation between the Dissociation Constant of Weak Acids and the Hydrolysis of their Alkaline Salts. By JAMES WALKER (*Zeit. physikal. Chem.*, 1900, 32, 137—141).—The author has recently determined the dissociation constants of a number of weak inorganic acids (Walker and Cormack, *Trans.*, 1900, 77, 5). From these results, the values of the hydrolysis of the sodium salts may be calculated by the expression $x^2/(1-x)v = k^2/c$, where x is the quantity of salt hydrolysed, and k and c are respectively the dissociation constants of water and the acid. By the reverse calculation, van Laar obtained values for the dissociation of hydrocyanic acid and phenol considerably higher than the experimental determinations of the author, but this was due to the use of an erroneous high value for the dissociation of water (*Abstr.*, 1894, ii, 132). The following values are obtained for the percentage hydrolysis of the sodium salts in $N/10$ solutions: Acetate, 0.008; bicarbonate, 0.06; hydrosulphide, 0.14; metaborate, 0.84; cyanide, 0.96; phenoxide, 3.0; these agree satisfactorily with the direct determinations of Shields (*Abstr.*, 1893, ii, 418), acetate, 0.008; borax, 0.5; cyanide, 1.1; phenoxide, 3.0. The hydrolysis of sodium phenoxide calculated by the author is also in accord with the direct determinations of Hantzsch, although the determinations of the conductivity made by the latter do not agree with the author's results (*this vol.*, i, 94).

L. M. J.

Hydrolysis of Salt Solutions. By LUDWIK BRUNER (*Zeit. physikal. Chem.*, 1900, 32, 133—136).—Results are communicated of work on the same lines as that of Ley (*this vol.*, ii, 67) on the hydrolytic dissociation of salts. The method of sugar inversion was employed for the measurement of the dissociation, and the following results were obtained. The chlorides of quadrivalent elements are considerably hydrolysed, stannic chloride at $v=8$ being almost completely decomposed and zirconium chloride being hydrolysed to the extent of 35 per cent. at $v=64$. In other salts examined, the hydrolysis was in the following order: ferric chloride, uranyl chloride, uranyl nitrate, uranyl sulphate, aluminium chloride, aluminium nitrate, aluminium sulphate, beryllium chloride, beryllium nitrate, beryllium sulphate, and the percentage hydrolysis at three dilutions is given. The hydrolysis is not noticeable, or is too small for measurement in solutions of ammonium, potassium, lithium, manganese, cobalt, cerium, erbium, barium, strontium, calcium, and magnesium chlorides, and in silver, manganese and cobalt nitrates. In general, the chlorides appear to be hydrolysed to the greatest extent, then the nitrates, and the sulphates least. The results are in good accord with those of Ley and the temperature coefficient of the hydrolysis may in some cases be estimated from the two sets of determinations.

L. M. J.

Catalysis with Normal Salts. By HANS EULER (*Zeit. physikal. Chem.*, 1900, 32, 348—359).—The inversion of sugar and the catalysis of esters by acids are both accelerated in the presence of normal salts. In the former case, the influence of a small quantity of a normal salt is nearly independent of the sugar concentration, whilst the acceleration due to the normal salt is the more marked the more dilute the acid is. On the supposition that all chemical compounds are electrolytes, and that every catalytic action consists in a change of concentration of the ions involved, the author considers that the accelerating action of normal salts is due to an increased osmotic pressure of the sugar and ester ions, or to an increased reactive capacity on the part of the water. Normal salts may increase the dissociating power of the solvent, and thus increase the osmotic pressure of the sugar and ester, whilst on the other hand the normal salt may increase the number of hydrogen and hydroxyl ions formed from the water.

J. C. P.

Colloidal Solutions. By GEORG BREDIG and A. COEHN (*Zeit. physikal. Chem.*, 1900, 32, 129—132).—Stoeckl and Vanino (this vol., ii, 11) add nothing new regarding colloidal solutions, the evidence recorded having been previously stated by Linder and Picton (*Trans.*, 1892, 61, 137, 148, 1895, 67, 63) and by Barus and Schneider (*Abstr.*, 1891, 1412). Stark's view that precipitation is due to the separation of dissolved air (*Abstr.*, 1899, ii, 644) is untenable, as colloidal solutions under reduced pressure evolve air without precipitation and may afterwards be precipitated by dilute sulphuric acid and other electrolytes.

L. M. J.

Stereoisomerides and Racemic Compounds. By HERMAN C. COOPER (*Amer. Chem. J.*, 1900, 23, 255—261).—The solubility curves for sodium hydrogen dextro- and lævo-tartrates in aqueous solutions of dextrose are coincident. The same holds for the two optically active sodium ammonium tartrates.

In a discussion on partial racemism, the possibility of obtaining a racemic compound the active components of which are not chemically equivalent is suggested.

T. H. P.

Recognition of Racemic Compounds. By GIUSEPPE BRUNI (*Gazzetta*, 1900, 30, i, 35—39).—The method given by Roozeboom (*Abstr.*, 1899, ii, 276 and 401) for the recognition of racemic compounds, pseudoracemic mixtures, and inactive conglomerates by means of their melting point curves has a complete analogue in the author's method, in which the solubility is examined; in place, however, of the ordinary curves of solubility, in which the latter is considered as a function of the temperature, solubility curves are made use of, which only consider the relative quantities of the two enantiomorphous isomerides present and take no account of the solvent. The various types of such solubility curves, which are similar to the melting point curves of Roozeboom (*loc. cit.*), are as follows. For a racemic compound, the curve consists of three distinct parts and has two minima and a maximum, which may, however, be less than or greater than

the solubility of either of the components; for an inactive conglomerate, the curve is composed of two parts with one minimum, whilst the curve corresponding with a pseudoracemic mixture is continuous,

T. H. P.

Water of Crystallisation. II. By THEODOR SALZER (*J. pr. Chem.*, 1900, [ii], 61, 157—165. Compare Abstr., 1895, ii, 488, and 1898, i, 315).—Calcium malonate and methylmalonate are held to be trimolecular, since when air dried they have the composition $\text{CaC}_3\text{H}_2\text{O}_4 + 1\frac{1}{2}\text{H}_2\text{O}$ and $\text{CaC}_4\text{H}_4\text{O}_4 + 1\frac{1}{2}\text{H}_2\text{O}$; the salts $\text{CaC}_3\text{H}_2\text{O}_4 + 4\text{H}_2\text{O}$ and $\text{CaC}_3\text{H}_2\text{O}_4 + 2\text{H}_2\text{O}$ are also found to be less soluble than the anhydrous salt. Calcium propylmalonate has the composition $\text{CaC}_6\text{H}_8\text{O}_4 + 2\text{H}_2\text{O}$; the butylmalonate, $\text{CaC}_7\text{H}_{10}\text{O}_4 + 2\text{H}_2\text{O}$, loses all its water of crystallisation at 110° ; the dimethylmalonate forms readily soluble needles, $\text{CaC}_6\text{H}_6\text{O}_4 + 3\text{H}_2\text{O}$, loses its water of crystallisation at 110° , and begins to decompose at 162° , whilst the acid first melts at 192° ; the methylmalonate crystallises with $3\text{H}_2\text{O}$. The author withdraws his earlier conclusions with regard to the water of crystallisation of calcium malonate and its homologues.

Other examples of salts which are to be regarded as trimolecular are Fittig's barium propylitaconate, $\text{BaC}_8\text{H}_{10}\text{O}_4 + 1\frac{1}{2}\text{H}_2\text{O}$, and calcium dimethylfumarate, which loses two-thirds of its water of crystallisation when heated.

On repeating the work of Rahlis (*Annalen*, 1879, 198, 106), it is found that calcium *o*-bromobenzoate crystallises with only $2\text{H}_2\text{O}$ and is therefore in agreement with Rule VIII (Abstr., 1898, i, 315). Calcium *p*-bromobenzoate, when prepared from calcium chloride and the ammonium salt at the ordinary temperature, crystallises in minute needles containing $3\text{H}_2\text{O}$, in agreement with Rule VIII, but when the solution is evaporated on a water-bath, separates in tablets with $1\text{H}_2\text{O}$.

T. M. L.

Relation of the Taste of Acid Salts to their Degree of Dissociation. By LOUIS KAHLBERG (*J. Physical Chem.*, 1900, 4, 33—37).—Experiments on the taste of acids have indicated that the sour taste is ascribable to the hydrogen ions (Richards, Abstr., 1898, ii, 209). Experiments with acid sodium salts of a number of slightly dissociated acids prove, however, that the sour taste is obtained at concentrations of the hydrogen ion far below the limit for acids which had been previously found, and that the sour taste of these acid sodium salts cannot be ascribed to the hydrogen ions present. It hence appears that it must be due to the acid ion, and owing to the discrepancy between these results and those of Richards, the author considers the explanation of the sour taste from the standpoint of the dissociation theory to be unsatisfactory (see also Höber and Kiesow, Abstr., 1899, ii, 206).

L. M. J.

Laboratory Apparatus for Roasting Large Quantities of Material. By G. PAUL DROSSBACH (*Ber.*, 1900, 33, 486).—The apparatus consists of a horizontal metal tube, open at one end and provided with a gas delivery tube at the other; it carries a hopper on its upper

surface, and is fitted with a worm worked by a grooved wheel and cord. The whole may be heated in a furnace; the worm fits loosely into the tube, so that no lubricant is required. J. J. S.

Inorganic Chemistry.

Volumetric Composition of Hydrogen Fluoride. By HENRI MOISSAN (*Compt. rend.*, 1900, 130, 544—548).—The volumetric composition of hydrogen fluoride was determined (1) by electrolysing aqueous hydrogen fluoride, collecting and measuring the liberated hydrogen, and the oxygen formed by the fluorine acting on the water, and (2) by allowing a measured volume of fluorine to act on water, the liberated oxygen being measured, and the quantity of hydrofluoric acid formed being estimated by titration. In all cases, the ozone in the oxygen was either decomposed by heating or estimated by titration. The results show that hydrogen fluoride is formed by the union of equal volumes of hydrogen and fluorine.

C. H. B.

Vapour Density of Sulphur. By CARL SCHALL (*Ber.*, 1900, 33, 484—485).—A reply to adverse criticisms by Bleier and Cohn (this vol., ii, 203). Further determinations of the vapour density of sulphur at low pressures (to 42·7 mm.) give densities varying from 7·15 to 7·5 compared with oxygen.

J. J. S.

Products of the Action of Sulphur Dioxide on Ammonia. By HANS SCHUMANN (*Zeit. anorg. Chem.*, 1900, 23, 43—66. Compare Divers and Ogawa, *Trans.*, 1900, 77, 327).—The action of dry sulphur dioxide on dry ammonia results in the formation of the compound $\text{SO}_2\cdot\text{NH}_3$ in the presence of excess of sulphur dioxide, and in the formation of the compound $\text{SO}_2\cdot 2\text{NH}_3$ in the presence of excess of ammonia. The condensation is effected in a flask cooled at 0° , one of the gases being passed through mercury, the other gas entering above the mercury. It is essential that the gases should be carefully dried.

The compound $\text{SO}_2\cdot\text{NH}_3$ is a yellow, crystalline powder, very hygroscopic, and at once decomposed by water, yielding a faintly acid solution, which, on the addition of acids, evolves sulphur dioxide without the immediate precipitation of sulphur; the freshly prepared solution contains ammonium salts and sulphuric, sulphurous, thiosulphuric, trithionic, and pentathionic acids.

The compound $\text{SO}_2\cdot 2\text{NH}_3$, prepared in a flask cooled at -5 to -7° , forms red fragments, and nodular, seemingly crystalline conglomerates, is not so hygroscopic as the preceding compound, and remains undecomposed for some time on exposure to the air, but gradually changes into a white powder. It dissolves in water, with evolution of ammonia; the solution gives a transitory carmine coloration on the addition of

acids, and when freshly prepared, contains the same acids as that of the preceding compound.

The compound $\text{SO}_2\cdot\text{NH}_3$, when heated under dry carbon disulphide in a reflux apparatus, decomposes with evolution of ammonia, and forms a dark red, crystalline sublimate of the composition $3\text{SO}_2\cdot 4\text{NH}_3$, which is very hygroscopic, and yields a solution in water similar to that of the compound $\text{SO}_2\cdot 2\text{NH}_3$.

Potassamide, when heated in sulphur dioxide at 200° , undergoes a violent reaction, with evolution of light and heat; the products are a mixture of the compounds $\text{SO}_2\cdot\text{NH}_3$ and $\text{SO}_2\cdot 2\text{NH}_3$, and a residue containing potassamide, potassium, sulphur dioxide, and small quantities of ammonia.

Similar compounds are obtained by the action of sulphur dioxide on the anhydrous fatty amines, when brought into direct contact without the presence of a solvent at about -6° . Ethylamine yields the compound $\text{SO}_2\cdot\text{NH}_2\text{Et}$, which crystallises in yellow scales and yields a colourless solution in water containing the amine and sulphuric, sulphurous, thiosulphuric, trithionic, and pentathionic acids. The compound $\text{SO}_2\cdot\text{NHMe}_2$, obtained from dimethylamine, is a yellow, crystalline mass, and with water gives a faintly acid solution which contains the amine and sulphuric, sulphurous, and thiosulphuric acids only.

E. C. R.

Reduction of Selenium Dioxide by Sodium Thiosulphate. By JAMES F. NORRIS and HENRY FAY (*Amer. Chem. J.*, 1900, 23, 119—125).—The interaction between selenium dioxide and sodium thiosulphate (*Abstr.*, 1897, ii, 70) probably takes place thus: $\text{SeO}_2 + 4\text{Na}_2\text{S}_2\text{O}_3 = 2\text{Na}_2\text{S}_4\text{O}_6 + \text{Se} + 2\text{Na}_2\text{O}$; in concentrated solutions, selenium is precipitated, and the solution becomes alkaline, but in dilute solution no selenium is precipitated, and the reaction is not complete according to this equation, owing to the sodium hydroxide formed neutralising part of the selenious acid, which, therefore, does not enter into reaction. In presence of hydrochloric acid, the action occurs according to the equation: $\text{SeO}_2 + 4\text{Na}_2\text{S}_2\text{O}_3 + 4\text{HCl} = \text{Na}_2\text{S}_4\text{SeO}_6 + \text{Na}_2\text{S}_4\text{O}_6 + 4\text{NaCl} + 2\text{H}_2\text{O}$. No selenium is precipitated, but sodium selenotetrathionate is formed, which, although it cannot be isolated, gives Debus's tests for pentathionates (*Trans.*, 1888, 53, 278), with the difference that selenium, not sulphur, is precipitated; a dilute solution of the salt can be boiled without change, but stannous chloride precipitates selenium in a few minutes; sodium thiosulphate effects the same result, but more slowly. The sodium tetrathionate, formed according to the equation, was isolated and identified.

An acid solution of tellurium dioxide yields, with sodium thiosulphate, a solution apparently containing a compound analogous to a selenotetrathionate; this is remarkable, since no compounds of tellurium analogous to the thionates are known.

Incidentally, the authors point out that in presence of dilute acids the starch reaction for iodine is about 0.2 per cent. more sensitive at 3° than at the ordinary temperature.

W. A. D.

Preparation of Pure Tellurium. By JAMES F. NORRIS, HENRY FAY, and D. W. EDGERLY (*Amer. Chem. J.*, 1900, 23, 105—119).—The

basic tellurium nitrate obtained by dissolving tellurium in nitric acid is not hygroscopic, and appears to have the composition $4\text{TeO}_2 \cdot \text{N}_2\text{O}_5 + \text{H}_2\text{O}$, rather than $4\text{TeO}_2 \cdot \text{N}_2\text{O}_5 + 1\frac{1}{2}\text{H}_2\text{O}$ (Klein and Morel, *Abstr.*, 1884, 1256, and 1885, 16); since water is not given off on heating the salt until about 190° , when decomposition begins, it is probably present combined according to the formula $\text{Te}_2\text{O}_5(\text{OH})(\text{NO}_3)$. The tellurium obtained by dissolving the oxide prepared from the pure nitrate in pure hydrochloric acid, precipitating with sulphur dioxide, and distilling the metal so obtained, on careful examination does not show the presence of any other element.

The double bromide of tellurium and potassium, prepared from tellurium dioxide, hydrobromic acid, and potassium bromide, was fractionally crystallised by a process involving over 200 crystallisations; since the last fractions, when converted into the nitrate, gave practically the same loss of weight on ignition as the earlier ones, no evidence could be obtained by this process in favour of Brauner's view (*Trans.*, 1889, 55, 382; 1895, 67, 549) that tellurium is a mixture of "true tellurium" with an atomic weight of about 125 and another element with a higher atomic weight. The abnormal position of tellurium in the eighth group of the periodic classification of the elements still awaits explanation.

W. A. D.

Specific Gravity and Electrical Resistance of Tellurium. By VICTOR LENHER and J. LIVINGSTON R. MORGAN (*J. Amer. Chem. Soc.*, 1900, 22, 28—31).—The specific gravity of powdered tellurium, obtained by reduction of the alkaline solution of the oxide by sugar, was determined by the pycnometer method. The values obtained varied from 6.194 to 6.204, with a mean of 6.1993. For the determination of the electrical resistance, the molten metal was allowed to solidify in glass tubes of narrow bore jacketed by outer tubes also containing melted tellurium. Great difficulty was found, however, in obtaining uniform results, the values for the specific resistance varying from 279 to 1152; the mean is about 500, but the authors consider that the lower results are probably the more correct. The value obtained by Matthieson was about 2000, so that the structure has an enormous influence on the conductivity. It was observed that the metal expands slightly immediately after solidification, all the tubes cracking at this point, no matter how slowly they were cooled.

L. M. J.

Surface-tensions of Mixtures of Sulphuric Acid and Water, and the Molecular Mass of Sulphuric Acid. By CHARLES E. LINEBARGER (*J. Amer. Chem. Soc.*, 1900, 22, 5—11).—By the aid of the apparatus previously described by the author (*Abstr.*, 1897, ii, 247), measurements were made of the surface tension of aqueous sulphuric acid at concentrations varying from 2.65 to 95 per cent., and at temperatures varying from 0° to 70° . It was found the surface tension of both acid and water is raised by addition of the other component, the composition of the mixture possessing the highest surface tension being about 60 per cent., but varying slightly with temperature. For the higher concentrations, the influence of temperature is very slight, and this should indicate a high degree of polymerisation, so that the molecule of sulphuric acid is probably very complex, and this

complexity may account for many of the extraordinary properties of mixtures of sulphuric acid and water. According to the views of Brühl (Abstr., 1896, ii, 163), it should be a compound of high dissociative power, and the maximum conductivity of solutions of water in sulphuric acid at a concentration of 10 per cent. are probably to be ascribed to the dissociation of the water, the fall with increased concentration being due to the increased viscosity.

L. M. J.

A New Nitrogen Iodide, N_3I . By ARTHUR HANTZSCH (*Ber.*, 1900, 33, 522—527).—On adding an ethereal solution of iodine to silver azoimide suspended in water at 0° , extracting with ether, and allowing the latter to evaporate below 0° , a nearly colourless solid is obtained, which, from a determination of the ratio of nitrogen to iodine in a freshly prepared aqueous solution, appears to have the composition N_3I ; the dry substance often decomposes spontaneously with great violence, giving rise to nitrogen and iodine, whilst the same products are formed when slow decomposition occurs in benzene or chloroform solution. An aqueous solution of the iodide is at first neutral to litmus, and produces no coloration with starch solution, but decomposition occurs somewhat rapidly to azoimide and hypoiodous acid, which is then further resolved into iodine and iodic acid. Aqueous silver nitrate gives rise, similarly, to silver azoimide, iodine, and iodic acid, a reaction which furnishes the means of determining the ratio of iodine to nitrogen present in the compound.

All attempts to prepare the condensation product N_6 were unsuccessful.

W. A. D.

Nitrogen Iodide. By C. HUGOT (*Compt. rend.*, 1900, 130, 505—508. Compare Chattaway, *Trans.*, 1896, 69, 1572; *Proc.*, 1899, 15, 17).—When ammonia gas is passed into a cooled vessel containing iodine, a dark brown liquid is first produced; this becomes red, and finally assumes a faint yellow colour, whilst the compound, $NI_3 \cdot 3NH_3$, separates in dark green needles. The yellow liquid contains the ammonio-ammonium iodide, $NH_4I \cdot 3NH_3$, dissolved in liquid ammonia, together with small quantities of free iodine, and the compound $NI_3 \cdot 3NH_3$. The reaction appears to take the following course: $16NH_3 + 6I = 3(NH_4I \cdot 3NH_3) + NI_3 \cdot 3NH_3$.

The ammonio-nitrogen iodide, $NI_3 \cdot 3NH_3$, when maintained at a temperature of -30° in a vacuum, loses one-third of its ammonia, and a well-defined, crystalline, yellow compound, $NI_3 \cdot 2NH_3$, is produced; at 0° in a vacuum, the latter substance parts with half its ammonia, yielding violet needles of the compound $NI_3 \cdot NH_3$. It is not possible to eliminate the last mol. of ammonia, since the third compound is decomposed on warming, and at about 50° a violent detonation is produced.

G. T. M.

The Molecule of Carbon and the Supposed Negative Heat of Formation of various Carbon Compounds. By WILHELM VAUBEL (*Zeit. angew. Chem.*, 1900, 60—63).—Calculations based on the difference between the heats of combustion of carbon and carbon monoxide lead the author to the conclusion that the molecule of

carbon at its boiling point contains 24 atoms. The heat of dissociation of this complex carbon molecule is taken as 32300 cal., and hence it is deduced that acetylene, carbon disulphide, and other compounds which have commonly negative heats of formation assigned to them, have really positive heats of formation. The author proposes to recalculate on this new basis the heats of formation of organic compounds.

J. C. P.

Preparation of Amorphous Silicon, Silicon Sulphide, Silicon Chloride, and Thiosilicates. By WALTHER HEMPEL and VON HAASY (*Zeit. anorg. Chem.*, 1900, 23, 32—42).—Amorphous silicon is prepared easily and in considerable quantities by heating sodium in an atmosphere of silicon fluoride. The apparatus, which is figured in the original paper, consists of a generator of silicon fluoride and a special iron retort so arranged that when heated and filled with silicon fluoride, sodium can be expeditiously introduced in successive small portions. The product consists of silicon, sodium fluoride, and sodium silicofluoride; it is powdered and heated with sufficient sodium to decompose the silicofluoride and with sufficient aluminium to form an alloy containing not more than 16 per cent. of silicon. When cold, the alloy is separated mechanically from the fused mass, and the aluminium dissolved in hydrochloric acid. The amorphous silicon is lead-grey, amounts to 90—95 per cent. of the theoretical yield, and contains 3—4 per cent. of silica; this is extracted with hydrofluoric acid, and brown, amorphous silicon, amounting to 60—62 per cent. of the theoretical yield, is obtained in a very active form, which, when gently heated in the air, burns to silica. By melting aluminium with silicon, alloys containing up to 22·5 per cent. of silicon can be prepared, but the silicon separated from these is very inert. Silicon from an alloy containing 16·5 per cent. burns in chlorine at 280°, that from an alloy containing 22·5 per cent. at 340—350°.

Silicon sulphide is obtained by melting amorphous silicon with three times its weight of sulphur, and then throwing the fused mass into a red-hot crucible in successive small portions. The product contains 92—95 per cent. of silicon sulphide mixed with silicon and silica, and is purified by sublimation under diminished pressure. It crystallises in beautiful, long, white needles. Silicon chloride is easily prepared by heating the amorphous silicon in a current of chlorine.

Sodium metathiosilicate, Na_2SiS_3 , obtained by melting pure sodium sulphide with silicon sulphide, is a brownish-black mass which evolves hydrogen sulphide when treated with water, yielding a solution which does not evolve more hydrogen sulphide when treated with acids; when treated with chlorine, it yields sulphur chloride and silicon chloride with development of much heat. The authors have applied this last reaction to detect the presence of thiosilicates in some complex silicates, and obtained the following results: ultramarine, 0·174 per cent. SiS_2 ; blast furnace slags, 0·043, 0·009, and 0·104 per cent. SiS_2 ; lava from Vesuvius, 0·007 per cent. SiS_2 . They also point out that the sulphur present in many of the sulphur springs may be due to the decomposition of thiosilicates.

E. C. R.

Preparation of Arsenides, Antimonides, and Alloys of the Alkali Metals. By PAUL LEBEAU (*Compt. rend.*, 1900, 130, 502—505).—Impure arsenides containing excess of the metal or arsenic are produced when the latter or its hydride, either in the gaseous or liquid state, reacts with an alkali metal. Liquefied hydrogen arsenide has no solvent action on the alkali metals, and, unlike liquid ammonia, does not form compounds with these elements.

Pure sodium arsenide, Na_3As , is prepared by heating to redness in a closed iron vessel a mixture of arsenic and sodium; an excess of the latter is employed and the uncombined metal is removed from the cooled product by means of liquid ammonia; the arsenide remains undissolved and is obtained in the form of small, black crystals. Sodium antimonide, bismuthide, and stannide, and the corresponding lithium and potassium compounds, have been produced in a similar manner.

G. T. M.

Electrolytic Formation of Potassium Chlorate. By ANDRÉ BROCHET (*Compt. rend.*, 1900, 130, 718—721. Compare this vol., ii, 205).—When a cold and almost neutral solution of potassium chloride is electrolysed, the whole of the electric energy is spent in producing hypochlorite; the greater portion of this substance, however, is at once transformed into chlorate, the transformation being accompanied by an evolution of oxygen; under certain conditions, the addition of potassium chromate prevents the decomposition of the hypochlorite. This transformation is made manifest on electrolysing a solution of potassium chloride containing potassium dichromate; this salt liberates hypochlorous acid, becoming itself converted into the neutral chromate, and the colour of the solution changes from orange to yellow; the change is reversed when the solution is left for twelve hours owing to the production of chloric acid, this acid partially displacing chromic acid and regenerating the dichromate.

The auto-oxidation of hypochlorous acid takes place even more rapidly in hot or alkaline solutions, the yield of available chlorine being correspondingly diminished.

G. T. M.

Presence of Potassium Nitrite in Brown Powder Residue when the Powder is Burnt in Air under Ordinary Pressure. By A. M. SETON and K. L. STEVENSON (*Chem. News*, 1899, 80, 221).—Brown powder burns more slowly than black powder, and leaves more residue, which is generally white or greyish-white, hygroscopic, and partly soluble in water. A complete analysis gave the following results: K_2CO_3 , 61.96; K_2SO_4 , 26.18; KNO_3 , 6.17; insoluble, 5.8 per cent.

D. A. L.

Isomeric Potassium Sodium Sulphites. By GEORGE S. FRAPS (*Amer. Chem. J.*, 1900, 23, 202—214).—The existence of two isomeric potassium sodium sulphites has been indicated by the work of Röhrig (Abstr., 1888, 649), Schwickler (Abstr., 1889, 942), and Barth (Abstr., 1892, 564). The author prepares the double sulphite, firstly, by dissolving sodium carbonate in a solution of potassium hydrogen sulphite, and, secondly, by the interaction of potassium carbonate and sodium hydrogen sulphite; from a number of experiments on the action of

ethyl iodide on these two products, it is concluded that there is no evidence of the existence of two isomeric double sulphites.

T. H. P.

Compounds of Metals among themselves. By NICOLAI S. KURNAKOFF (*J. Russ. Phys. Chem. Soc.*, 1899, 31, 927—948).—The relations between melting point and composition are given for the following mixtures: mercury and sodium, mercury and potassium, cadmium and sodium, lead and sodium, bismuth and sodium.

The melting point curve for sodium and mercury shows five transition points, at which the ratio of the number of atoms of sodium to the number of mercury atoms has the values: 5·690 : 1 (at 21·25°); 2·559 : 1 (at 67·0°); 1·020 : 1 (at 209·7°); 1 : 1·101 (at 218°); 1 : 4·571 (at 155°). The maximum melting point corresponds with the compound NaHg_2 . From the eutectic mixture ($\text{Na} : \text{Hg} = 5·690 : 1$), beautiful, hexagonal plates of indefinite composition separate. The compound Na_3Hg , described by Maey (Abstr., 1899, ii, 547), has probably the composition Na_nHg , where n is not greater than 2·559. For potassium-mercury, the curve has three transition points, namely, 195·0°, 129·0°, and 70·3°, the corresponding values for the ratio $\text{K} : \text{Hg}$ being 1 : 3·283, 1 : 6·350, and 1 : 10·556 respectively. The maximum melting point mixture has the composition KHg_2 . The compound KHg_{12} , described by several writers, is probably KHg_n , n being not greater than 10·556; Maey (*loc. cit.*) found that n does not exceed 11. From the researches of the author and others, definite compounds of sodium and mercury of the composition NaHg_n are shown to exist, as follows: (1) n less than 2·5 (NaHg_2); (2) NaHg ; (3) n between 1 and 2; (4) NaHg_2 ; (5) n between 2 and 5 (NaHg_3); (6) NaHg_5 or NaHg_6 . The definite mercury potassium compounds, having the formula KHg_n , are: (1) KHg ; (2) KHg_2 ; (3) n between 2 and 3·28 (KHg_3); (4) n between 3·28 and 6·3 (KHg_5 or KHg_6); (5) n between 6·3 and 10·5 (KHg_{10}).

The maximum points of the other curves correspond with compounds having the formulæ NaCd_2 , NaPb , and Na_3Bi . NaCd_2 separates in glistening octahedra.

T. H. P.

Persulphates of Rubidium, Cæsium, and Thallium. By HUGH MARSHALL (*J. Amer. Chem. Soc.*, 1900, 22, 48. Compare Abstr., 1899, ii, 747).—Rubidium and cæsium persulphates, obtained by double decomposition from ammonium persulphate, are isomorphous with the ammonium salt, whereas mixtures of these salts with the potassium salt crystallise in monoclinic crystals. Mixtures of the thallous and ammonium salts also crystallise in the monoclinic system, and are isomorphous with the preceding mixtures.

J. J. S.

Melting Point of Lithium. By GEORG W. A. KAHLBAUM (*Zeit. anorg. Chem.*, 1900, 23, 220—221).—The sample of lithium was prepared by A. Guntz by the electrolysis of a mixture of equal parts of lithium and potassium chlorides. The melting point was determined in a bath of dry paraffin, and found to be 186° (Bunsen and Matthiessen give 180°).

E. C. R.

Action of Hydrogen Peroxide on Barium Hydroxide. By ROBERT DE FORCRAND (*Compt. rend.*, 1900, 130, 716—718).—When

baryta water containing 1 mol. of barium hydroxide is treated with $\frac{1}{2}$ mol. of hydrogen peroxide, a precipitate is formed in 3 minutes, even in dilute solutions; the heat evolved during the first 2 minutes is 3.121 Cal., and this represents the heat of the reaction before the formation of any insoluble compound; when twice this quantity of the peroxide is employed, the heat generated is somewhat greater, namely, 4.350 Cal., and the immediate addition of 2 mols. of hydrochloric acid produces a further thermal change of 23.474 Cal. The addition of 2 and 3 mols. of the peroxide to two solutions, each containing 1 mol. of the barium compound, is accompanied by the development of 7.801 and 8.552 Cal. respectively, the corresponding heats of neutralisation by hydrochloric acid (2 mols.) being 19.958 and 18.984 Cal. The heat developed on adding 10 mols. of the peroxide to the solution of barium hydroxide is 12.261 Cal., and the heat of neutralisation by hydrochloric acid is 15.345 Cal.; when a larger excess of the peroxide (30 mols.) is employed, the thermal effect is 13.586 Cal. Two compounds appear to be successively produced, one, containing a large proportion of hydrogen peroxide, which has not been isolated, the other being the substance $\text{BaO}_2 \cdot \text{H}_2\text{O}_2$ studied by Schoene and Berthelot; the latter may be regarded as having the constitution $\text{Ba}(\text{O}\cdot\text{OH})_2$. The heat of neutralisation of this compound by barium hydroxide is 0.899 Cal., or 0.45 Cal. for each hydroxyl group; it appears, therefore, that the compound is slightly acidic. The formula $\text{Ba} \begin{array}{c} \diagup \text{O} \diagdown \\ \diagdown \text{O} \diagup \end{array} \text{Ba}$ is ascribed to the salt produced.

G. T. M.

Action of Metallic Magnesium on Water. By EDWARD G. BRYANT (*Chem. News*, 1899, 80, 211—212).—Magnesium of commerce, containing 1.77 per cent. of iron and 0.3 of calcium, but no detectable carbon, was found to evolve hydrogen when placed in water, the action continuing for many hours with decreasing energy, and finally ceasing. 0.1 gram of the powdered metal, placed in 100 c.c. of water, yielded 2—3 c.c. of hydrogen; this quantity could be increased by the addition of normal sodium sulphate, which dissolves magnesium oxide; heating the water did not cause a greater, but only a more rapid, evolution of hydrogen. The metal itself became tarnished, and, if polished, regained its activity. There was no question of a couple forming, and the gases in water were shown to have no effect on the action, which is a direct action of magnesium on water. One part of magnesium oxide dissolves in 225,000 parts of water. D. A. L.

Colloidal Cadmium. By GEORG BREDIG (*Zeit. physikal. Chem.*, 1900, 32, 127—8. Compare this vol., ii, 213).—Colloidal metallic solutions have been proved to consist of minute suspended particles of metals, and it hence follows that colloidal solutions of metals with a lower potential than hydrogen, such as cadmium or zinc, would be unstable and difficult to obtain. By means of an E.M.F. of 30—40 volts and a current of 5—10 ampères, an arc may be obtained between cadmium electrodes immersed in pure, air-free water, the cadmium being dispersed with the formation of a deep brown colloidal solution which changes to a blue-green, and coagulates on the addition of

electrolytes. By exposure to air, the solution speedily oxidises, but by exclusion of air, especially if the liquid be thickened by gelatin, it may be kept for a considerable time. L. M. J.

Action of Hydrogen Sulphide on Lead Peroxide. By LUDWIG VANINO and OTTO HAUSER (*Ber.*, 1900, 33, 625).—When hydrogen sulphide is passed over either moist or dry lead peroxide, the whole mass glows, and the gas burns with the characteristic lead flame. The reaction can be used, not merely as a lecture experiment, but may also be employed for starting an explosion, even with guncotton saturated with moisture. The reaction works best when the peroxide is collected in small heaps and not spread over a flat surface. Bismuth and silver peroxides give the same reaction, but lead oxide, manganese peroxide, cobaltic hydroxide, or cupric oxide do not. J. J. S.

A New Type of Ammonio-copper Chromate. By M. C. SCHUYTEN (*Chem. Centr.*, 1900, i, 399—400; from *Bull. Acad. roy. Belg.*, [iii], 37, 649—656).—By treating an aqueous solution of copper sulphate and potassium dichromate with ammonia, or by adding potassium dichromate to an ammoniacal solution of cupric hydroxide from which the excess of ammonia has been removed by exposure to the air, a compound, $4\text{CuCrO}_4 \cdot 3\text{NH}_3 \cdot 5\text{H}_2\text{O}$, separates as a brown, amorphous powder; when heated, it evolves ammonia, water, and a small quantity of nitrous fumes, but the whole of the ammonia and water cannot be expelled even by heating for a long time at a high temperature. It dissolves in hydrochloric acid or ammonia, forming a yellow or a green solution respectively; it is also easily soluble in a solution of silver nitrate, but insoluble in organic solvents. Alcohol is not oxidised to aldehyde by boiling with the hydrochloric acid solution of this compound. E. W. W.

Mercury Derivatives of Nitrogen Compounds. By KARL A. HOFMANN and EDUARD C. MARBURG (*Zeit. anorg. Chem.*, 1900, 23, 126—134. Compare *Abstr.*, 1899, i, 486).—In answer to Pesci's criticisms (*Abstr.*, 1899, ii, 750), the authors maintain the correctness of their formulæ for the fusible and infusible precipitates obtained from mercuric chloride and ammonia in the presence of ammonium chloride. They point out that these compounds, HgNH_2Cl and $\text{Hg}(\text{NH}_2)_2\text{Cl}_2$, correspond with the ethylamine derivatives, HgNH_2EtCl , $\text{HgNH}_2\text{EtCl}_2$, and $\text{Hg}(\text{NH}_2\text{Et})_2\text{Cl}_2$, whereas ethylamine derivatives corresponding with compounds of the formulæ Hg_2NCl , NH_4Cl and $\text{Hg}_2\text{NCl} \cdot 3\text{NH}_4\text{Cl}$, could not be formed from an ethylated ammonia. The decomposition of the fusible and infusible precipitates by dilute alkalis naturally results in the formation of the theoretical quantity of mercuriammonium chloride, the first products of decomposition being alkali chloride, mercuric oxide and oxychloride, and ammonia; the mercuric oxide and ammonia, in the presence of halogen, then form the chloride of Millon's base and from 2 mercury atoms 1 mol. of mercuriammonium chloride is formed, 1 mol. of ammonia retained, and the excess of ammonia evolved.

Pesci's formulæ for Millon's base, $\text{Hg}_2\text{N} \cdot \text{OH} \cdot 2\text{H}_2\text{O}$, and the mercuriammonium salts, Hg_2NX , do not explain the behaviour of these

compounds on dehydration. Millon's base becomes dark brown on dehydration and the resulting compound, Hg_2NOH , is explosive and does not combine with hydrogen chloride to form salts. The salts of Millon's base are represented by the formula $(\text{HgOH})_2\text{NH}_2\text{X}$ and cannot be dehydrated without decomposition. The only exception is the nitrate, HgN_2NO_3 , which, when prepared from Millon's base, is not pure and on heating yields a small quantity of water. E. C. R.

Anhydrous Dimercuriammonium Iodide, Amorphous and Crystalline. By MAURICE FRANÇOIS (*Compt. rend.*, 1900, 130, 571—573).—Dimercuriammonium iodide, contrary to the usual statements, contains neither hydrogen nor oxygen, but is anhydrous and is a very stable substance. It is obtained in an amorphous state by the action of a large excess of concentrated ammonia solution on mercuric iodide or mercuridiammonium iodide, or, better, by the prolonged and repeated action of a 25 per cent. solution of sodium hydroxide on mercuridiammonium iodide. The crystallised compound is prepared by mixing a saturated solution of mercuridiammonium iodide in concentrated ammonia solution with twice its volume of the same concentrated ammonia solution. The crystals form slowly and are very dark purple by reflected light, but dark red brown by transmitted light. C. H. B.

Preparation and Properties of a Manganese Perfluoride. By HENRI MOISSAN (*Compt. rend.*, 1900, 130, 622—627).—Metallic manganese is attacked by fluorine at the ordinary temperature, but the reaction is limited by the formation of a layer of fluoride on the surface of the metal. If the manganese is finely powdered, the reaction takes place with incandescence, but the fluoride formed is partly volatilised and decomposed, so that the product is not of constant composition. Manganous fluoride is also attacked by fluorine, but the reaction is never complete, whilst with manganous chloride it is difficult to expel the whole of the chlorine. With manganous iodide, however, the reaction is much more regular, and manganese trifluoride, Mn_2F_6 , is obtained in crystals which preserve the form of those of the iodide from which it was derived, and have a sp. gr. 3.54. When heated, it decomposes with the production of manganous fluoride and fluorine, whilst it is reduced by hydrogen below a red heat, hydrogen fluoride and manganous fluoride being formed. At the ordinary temperature, chlorine, bromine, and iodine are without action on manganese trifluoride, but on heating, ternary compounds are formed, that with iodine being of a red colour. When the trifluoride is heated in glass, the latter is violently attacked, silicon fluoride being liberated, whilst a mixture of fluoride and oxyfluoride of manganese remains. Manganese trifluoride is decomposed by oxygen at a red heat with the formation of black, crystalline oxide of manganese. With sulphur at its boiling point, sulphur fluoride and manganous fluoride are formed; with phosphorus at a slightly elevated temperature, phosphorus trifluoride and pentafluoride are produced; and with arsenic, the trifluoride is obtained. Silicon, boron, and carbon are converted into fluorides by the action of manganese trifluoride. When heated in an atmosphere of hydrogen chloride, manganous

chloride, hydrogen fluoride, and free chlorine are formed. Sulphuric, nitric, and hydrochloric acids dissolve manganese trifluoride, forming dark brown solutions which are decomposed by excess of water. The action of water alone results in the formation of manganous fluoride, hydrofluoric acid, and a hydrated oxide of manganese, the relative proportions of these products depending on the amount of water employed. Manganese trifluoride readily reacts with hydrogen sulphide, sulphur chloride, and sulphuryl chloride, whilst with phosphorus trichloride it yields phosphorus fluorochloride, PF_2Cl_2 , and with phosphorus pentachloride the pentafluoride. With carbon tetrachloride, the products obtained are a white manganese fluoride, chlorine, and carbon fluoride. Organic substances, such as benzene, turpentine, chloroform, alcohol, and ether are without action on manganese trifluoride, even at 100° .

N. L.

Ferric Oxide Solution obtained by Dialysis. By WILLY WOBBE (*Chem. Centr.*, 1900, i, 165; from *Pharm. Centr.-H.*, 40, 793—796).—A solution of ferric oxide may be obtained by dialysing a solution of ferric oxychloride prepared by adding ammonia to a solution of ferric chloride in small portions at a time, so that after each addition the ferric hydroxide is completely dissolved on stirring. The clear, dark brown solution so obtained scarcely tastes of iron. It is evaporated until it contains 3.5 per cent. of iron, and has a sp. gr. 1.05. The last traces of chlorine cannot be removed by dialysis, and the product still contains 0.75 per cent. of ferric chloride, but it is free from ammonium salts. Attempts to completely remove the chloride by a process of hot dialysis appear to promise success. The solutions of ferric oxychloride and of ferric oxide may be boiled for some time without decomposing. The possibility of concentrating a solution of ferric oxychloride by heat renders unnecessary the pressing of the ferric hydroxide in the preparation of the solution for pharmaceutical purposes. After removing the supernatant liquid, the precipitate is added in small portions to the hydrochloric acid, and the solution then evaporated to the required density.

E. W. W.

Preparation of the Phosphides of Iron, Nickel, Cobalt, and Chromium. By GEORGES MARONNEAU (*Compt. rend.*, 1900, 130, 656—658).—A number of metallic phosphides were obtained in a well crystallised state by heating a mixture of the finely divided metal with copper phosphide in the electric furnace, the product of the reaction being treated with nitric acid to remove the copper. Iron phosphide, Fe_2P , was thus obtained in the form of whitish-grey, brilliant needles having a sp. gr. 6.57. Nickel phosphide, Ni_2P , crystallises in transparent, grey needles of sp. gr. 6.3, whilst cobalt phosphide, Co_2P , of similar appearance, has a sp. gr. 6.4. Chromium phosphide, CrP , forms dull grey crystals of a sp. gr. 5.71. The phosphides of iron, nickel, and chromium are insoluble in all acids except a mixture of nitric and hydrofluoric acids; cobalt phosphide is dissolved by concentrated nitric acid, and is slowly attacked by hydrochloric and sulphuric acids.

N. L.

Alloys of Platinum and Palladium with Cadmium, Zinc, and Magnesium. By W. R. EATON HODGKINSON, R. WABING, and A. P. H. DESBOROUGH (*Chem. News*, 1899, 80, 185).—A weighed quantity of platinum or palladium foil contained in a porcelain boat was placed close to a porcelain boat containing a large excess of the volatile metal and heated above the boiling point of the latter in refractory glass tubing; during the experiment, either a current of dry hydrogen was passed over the volatile metal towards the platinum or a vacuum was induced by means of a Sprengel pump at the platinum end of the tube. At the close of the experiment, the platinum or palladium in the boat was weighed and examined. With platinum, cadmium formed an alloy, PtCd_2 , which was white, crystalline, and brittle, and from which cadmium does not volatilise at full redness; when treated with nitric acid, some platinum dissolved as well as the cadmium. With zinc, the results were less definite, but if heated to a point where the glass tube collapsed, a brittle, crystalline alloy was obtained similar in character to the cadmium alloy, but of the composition PtZn . Magnesium proved still more troublesome, as its vapour was absorbed by the glass, but by lining the tube with magnesium oxide, a friable, crystalline alloy was produced of the composition PtMg_2 .

Experiments with palladium and with nickel have yielded only negative results.

D. A. L.

Complex Palladium Salts. By ARTHUR ROSENHEIM and HERMANN ITZIG (*Zeit. anorg. Chem.*, 1900, 23, 28—31).—*Potassium palladous iodonitrite*, $\text{K}_2\text{PdI}_2(\text{NO}_2)_2 + 3\text{H}_2\text{O}$, obtained by saturating a concentrated solution of potassium nitrite with palladous iodide and allowing the mixture to crystallise over sulphuric acid, crystallises in purplish-red, prismatic needles, effloresces on exposure to the air, and decomposes when dissolved in water or treated with dilute acids, with precipitation of palladous iodide.

Potassium palladous oxalonitrite, $\text{K}_2\text{Pd}(\text{NO}_2)_2\text{C}_2\text{O}_4$, obtained by warming the preceding salt with a molecular proportion of oxalic acid, crystallises in beautiful, yellow needles sparingly soluble in cold, but easily so in hot, water.

Ammonium palladous trichlorosulphite, $(\text{NH}_4)_3\text{PdCl}_3\text{SO}_3 + \text{H}_2\text{O}$, obtained by saturating a concentrated solution of ammonium sulphite with ammonium palladochloride, crystallises in bright red, hexagonal crystals [$\alpha : c = 1 : 0.8923$].

E. C. R.

Mineralogical Chemistry.

Roumanian Petroleums. By ALFONS O. SALIGNY (*Chem. Centr.*, 1900, 60; from *Bul. Roumanie*, 8, 351—365).—In the original paper, the physical and chemical properties of 12 kinds of Roumanian

petroleum are described and tabulated. The flash points of the various fractions are given, and their suitability for use as burning oils is also discussed. These petroleums contain very variable amounts of volatile oils, and ethylisobutane and isopropane were found in the fractions boiling below 70°.

E. W. W.

Melonite from South Australia. By ALFRED J. HIGGIN (*Trans. Roy. Soc. South Australia*, 1899, 23, 211—212).—This mineral, previously only known from California, has now been found with quartz and calcite at Worturpa, South Australia. The thin lamellæ have a brilliant metallic lustre; the cleavage planes are silver-white to reddish-brown. $H=1.5$; sp. gr., 7.6. Analyses I and II agree with the formula Ni_2Te_8 (compare this vol., ii, 22).

	Te.	Ni.	Au.	Insol.	Total.
I.	74.49	22.99	0.329	2.091	99.90
II.	71.500	21.274	0.018	7.319	100.11

Traces of bismuth and lead are present. On dissolving the mineral in nitric acid, the gold is left as bright spangles.

L. J. S.

Titaniferous Magnetites. By JAMES F. KEMP (*School of Mines Quart.*, 1899, 20, 323—356; 21, 56—65).—Titaniferous magnetites, with the exception of the occurrences in sands, are almost invariably found associated with rocks of the gabbro type, and have originated by a process of segregation from the magma. The mineral, as a rule, contains vanadium, chromium, nickel and cobalt, which together may amount to several per cent. (compare Abstr., 1899, ii, 109). Phosphorus and sulphur are low, or entirely absent. A description is given of the occurrence of titaniferous magnetites in each country of the world. Numerous references and analyses are quoted. Although abundant in certain regions, the mineral is not at present worked as an ore.

L. J. S.

Manganese Nodules from New South Wales. By WILLIAM M. DOHERTY (*Rept. Australian Assoc. Adv. Sci.*, 1898, 7, 339).—In the scrub-land near Onybygambah, on the Tweed river, are scattered about numerous spherical nodules which are dark and shining, with the appearance of seeds, or dull black; they are soft, and of the size of a pea to that of a Barcelona nut. Analyses gave:

MnO ₂	Fe ₂ O ₃ , Al ₂ O ₃	MgCO ₃	Organic Matter.	Gangue.
24.70	11.20	2.00	12.00	49.60
25.00	8.70	2.60	12.80	50.20
40.60	14.00	3.10	10.00	32.10

L. J. S.

Egyptian Soda Valleys. By G. SCHWEINFURTH and L. LEWIN (*Jahrb. Min.*, 1900, i, 236—237; from *Zeit. Ges. Erdkunde*, 1898, 33, 1—25).—The following analyses of the natural soda, as exported, are given. I. Dirty white nodular concretions. II and III. "Natrūn Sultani," which separates out on the floor of the lakes. IV. Hopper-shaped crystals of salt on the surface of the lakes.

	I.	II.	III.	IV.	V.
$\text{Na}_2\text{CO}_3 + \text{NaHCO}_3 \dots$	85.86	80.56	87.98	0.212	66.80
$\text{NaCl} \dots \dots \dots$	7.00	10.40	4.00	98.00	18.44
$\text{Na}_2\text{SO}_4 \dots \dots \dots$	1.20	3.72	0.59	0.506	11.40

Analysis V is of material found in a tomb near Thebes, dating from 1500—1600 B.C. The lakes are probably supplied by Nile water, and it is suggested that the soda is formed by the interaction of calcium hydrogen carbonate and sodium sulphate, the latter being derived by the interaction of sodium chloride and gypsum. L. J. S.

Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XV. Formation of Glauberite at 25°. By JACOBUS H. VAN'T HOFF and D. CHIARAVIGLIO (*Chem. Centr.*, 1900, i, 59—60; from *Sitzungsber. Akad. Wiss. Berlin*, 1899, 810—818. Compare this vol., ii, 76).—At Leopoldshall, glauberite is found in isolated masses in the older rock salt 30 metres below the potassium chloride stratum, and under the kieserite region. The mineral also occurs in the upper layers of the kainite zone, and single crystals are found in the lower portions of the kieserite bed. When a solution of calcium chloride is mixed with a solution of sodium sulphate, and the mixture stirred and evaporated at 100°, the separation of gypsum is followed by the formation of needles of the compound, $\text{Na}_2\text{Ca}(\text{SO}_4)_2 + 2\text{H}_2\text{O}$, which are then, however, rapidly replaced by rhombohedra of glauberite, the latter change being complete when the liquid has been concentrated. The mother liquor was removed by means of alcohol. Calculations from experimental data and graphical representation of results show that glauberite is formed, together with the following minerals, at 25°: rock salt, epsomite, $\text{MgSO}_4 + 7\text{H}_2\text{O}$; picromerite, $\text{MgK}_2(\text{SO}_4)_2 + 6\text{H}_2\text{O}$; blöditte, $\text{MgK}_2(\text{SO}_4)_2 + 4\text{H}_2\text{O}$; thenardite, Na_2SO_4 ; and aphthitalite, $\text{K}_2\text{Na}(\text{SO}_4)_2$, and also that glauberite is not formed when sea water is evaporated at 25°. When crystals of glauberite are left in contact with sea water which is beginning to deposit sodium chloride or magnesium sulphate at 25°, they gradually disappear and gypsum is formed. E. W. W.

Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XVI. Hydrate of Magnesium Potassium Sulphate, $\text{Mg}_4\text{K}_2(\text{SO}_4)_5 + 5\text{H}_2\text{O}$. By JACOBUS H. VAN'T HOFF and N. KASSATKIN (*Chem. Centr.*, 1900, i, 368; from *Sitzungsber. Akad. Wiss. Berlin*, 52, 951—953).—In order to ascertain the conditions of the formation of langbeinite, $\text{Mg}_2\text{K}_2(\text{SO}_4)_3$, obtained by removing water from a mixture of magnesium and potassium sulphates, the progress of dehydration of a system, $\text{MgSO}_4 \cdot 6\text{H}_2\text{O} + \text{MgK}_2(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$, prepared by concentrating at 47.2° was followed. A hydrate of magnesium potassium sulphate, $\text{Mg}_4\text{K}_2(\text{SO}_4)_5 + 5\text{H}_2\text{O}$, was formed; it is a double salt of the hydrate, $\text{MgSO}_4 + \frac{1}{2}\text{H}_2\text{O}$ (*Abstr.*, 1899, ii, 759). It is also formed when a mixture of hexahydrated magnesium sulphate and leonite are heated at 72.5°. Its formation is easily recognised by means of the dilatometer or the thermometer, and depends on the mutual action of the salts, for solutions of these salts, when heated alone, do not show any such change. When a solution containing

magnesium sulphate (4 mols.) and potassium sulphate (1 mol.) is evaporated, leonite first separates, then the new compound in well formed needles, and finally the leonite disappears and the whole mass solidifies.

E. W. W.

Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XVII. A Relationship between the Composition of Solutions of Sodium Chloride and Potassium Chloride saturated at 25°. By HAROLD A. WILSON (*Chem. Centr.*, 1900, i, 368—369; from *Sitzungsber. Akad. Wiss. Berlin*, 52, 954—955).—In the diagram representing the relations of solubilities in the case of saturation with potassium chloride in presence of chlorides and sulphates of magnesium and potassium (*Sitzungsber. Akad. Wiss. Berlin*, 1898, 820), it is seen that, in the plane which indicates saturation with sodium chloride and potassium chloride, the data have a very simple relationship. If the composition is expressed in molecules of Na_2Cl_2 (a), K_2Cl_2 (b), MgCl_2 (c) and MgSO_4 (d) per 1000 molecules of water, then $b + c/5$ is a constant, that is, by the entry of each double molecule of potassium chloride, 1/5th of a molecule of magnesium chloride is expelled.

The following data are quoted :

	Saturation with		
	K_2Cl_2	MgCl_2	$\text{K}_2\text{Cl}_2 + \frac{\text{MgCl}_2}{5}$
NaCl and KCl.....	19.5	0	19.5
NaCl, KCl and apththalite	20	0	20
NaCl, KCl and carnallite	5.5	70.5	19.6
„ „ glaserite and picromerite.....	16	18.5	19.7
„ „ picromerite and leonite	14.5	25.5	19.6
„ „ leonite and $\text{MgSO}_4 + 6\text{H}_2\text{O}$	13	30.5	19.1
„ „ $\text{MgSO}_4 + 6\text{H}_2\text{O}$ and $\text{MgSO}_4 + 5\text{H}_2\text{O}$	6.5	63	19.1
„ „ $\text{MgSO}_4 + 5\text{H}_2\text{O}$ and carnallite.....	6	68	19.6
„ „ and $\text{MgSO}_4 + 6\text{H}_2\text{O}$	7.8	55.8	19
„ „ picromerite and $\text{MgSO}_4 + 6\text{H}_2\text{O}$...	9.5	42.5	18
„ „ in 20 per cent. MgCl_2	9.5	47.5	19

E. W. W.

Constitution and Classification of Silicates. By VASILE C. BUTUREANU (*Jahrb. Min.*, 1900, i, Ref. 184—186; from *Bul. Soc. Sci. Fis. Bucuresti*, 1896, 60—73, 129—139, 254—279).—The following is the classification given :

I. Neutral silicates.

a. Orthosilicates. General formula, $(\text{SiO}_4)_n(\text{M}'_4)_n$.

(1). Simple.

(2). Condensed.

b. Metasilicates. General formula, $(\text{SiO}_3)_n(\text{M}'_2)_n$.

(1). Simple.

(2). Condensed.

c. Polysilicates. Derived from meta- or ortho-silicic acid : general formulæ $\text{Si}_n\text{O}_{3n+1}\text{M}'_{2n+2}$, $\text{Si}_n\text{O}_{3n}\text{M}'_{2n}$, $\text{Si}_n\text{O}_{3n-1}\text{M}'_{2n-2}$ &c.

II. Basic silicates.

III. Acid silicates.

IV. Silicates with water of crystallisation.

V. Mixed silicates; for example, borosilicates, titanosilicates, &c.

Structural formulæ for each mineral species are given in the original. L. J. S.

Augite from Yoneyama, Japan. By C. IWASAKI (*Zeit. Kryst. Min.*, 1900, 32, 302; from ? [separate copy, 5 pp.]).—Augite crystals, up to 1 cm. across, occur in a weathered olivine-augite-andesite at Yoneyama, Prov. Echigo. A short, crystallographic description is given; sp. gr. 3.42. Analysis by Yoshida gave:

SiO ₂ .	Fe ₂ O ₃ .	Al ₂ O ₃ .	FeO.	CaO.	MgO.	K ₂ O.	Na ₂ O.	Total.
53.56	2.75	0.26	8.69	30.16	1.70	0.21	2.64	99.97.

L. J. S.

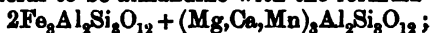
Westanite, Pyrophyllite and Kaolinite from Westana, Sweden. By MATS WEIBULL (*Jahrb. Min.*, 1900, i, Ref., 197—198; from *Geol. För. Förh.*, 1898, 20, 57—66).—A microscopical examination of Blomstrand's westanite shows it to consist of pyrophyllite derived by the alteration of andalusite. Pyrophyllite also occurs at Westana as colourless to yellow, six-sided crystals embedded in kaolinite. The optical properties of these crystals are given; sp. gr. 2.768. At about 600°, the material loses 5.11 per cent. of water, and none is lost below this temperature. The alteration of andalusite to pyrophyllite is expressed by the equation, $(\text{AlO})_2\text{SiO}_3 + 3\text{H}_2\text{SiO}_3 = 2(\text{AlH})(\text{SiO}_3)_2 + 2\text{H}_2\text{O}$.

The granular kaolinite, in which the pyrophyllite is embedded, gave the following results on analysis, agreeing with the usual formula $\text{H}_4\text{Al}_2\text{Si}_2\text{O}_9$,

SiO ₂ .	Al ₂ O ₃ .	MgO.	K ₂ O, Na ₂ O.	H ₂ O.	Total.	Sp. gr.
45.41	40.59	0.07	traces	13.90	99.97	2.598

L. J. S.

[Minerals in] the Pegmatites of the Upper Veltlin. By GOTTLOB ED. LINCK (*Jenaische Zeit. Naturwiss.*, 1899, 33, 345—360).—The crystalline schists between Sondalo and Bormio are penetrated by pegmatite masses containing quartz, plagioclase, muscovite, biotite and garnet with apatite, tourmaline, dumortierite, chrysoberyl, prehnite, zoisite, epidote and chlorite; descriptions are given of each of these minerals, and analyses of the following. Plagioclase is white and cloudy: I, from Val Lenasco, corresponds with $\text{Ab}_{81}\text{An}_{19}$; II, from Val Donbastone, with $\text{Ab}_{13}\text{An}_{87}$; optical determinations are also given. Garnet occurs as light coffee-brown crystals of the form $n\{211\}$; analysis by W. Schimpff of material from Val Donbastone gave III, showing the mineral to be almandine with the formula



the slight excess of silica and alumina is due to alteration. Dumortierite occurs at Val Donbastone as columnar crystals 5 cm. in length; it is pistachio-green or rarely bluish-green, and resembles epidote in appearance. The prism angle is $110^\circ 54'$, and there is a prismatic

cleavage. $H=7$. It is strongly pleochroic; optical determinations are given. Analysis by W. Schimpff gave IV; boron is also present.

	SiO ₂	Al ₂ O ₃	FeO	MnO	CaO	MgO	Na ₂ O	Loss on ignition.	Total.	Sp. gr.
I.	65.39	21.36	—	—	2.64	—	[10.61]	—	100	2.616—2.617
II.	64.12	22.48	—	—	4.23	—	[9.17]	—	100	2.623—2.625
III.	36.98	24.58	29.68	1.14	0.35	7.78	—	—	100.51	4.010
IV.	36.81	57.27	—	—	1.66	1.38	—	1.31	98.45	3.23

L. J. S.

Ransätite. By MATS WEIBULL (*Jahrb. Min.*, 1900, i, Ref., 187; from *Geol. För. Förh.*, 1898, 20, 53).—A re-examination of the supposed new mineral ransätite (Abstr., 1897, ii, 268) shows it to be an impure manganese garnet enclosing quartz, pyrophyllite, chloritoid, kyanite and ore particles (hæmatite?).

L. J. S.

Tourmaline from Elba. By E. MANASSE (*Jahrb. Min.*, 1900, i, Ref., 192; from *Proc. Verb. Soc. Toscana Sci. Nat.*, 1898, 11, 104—107).—A finely crystalline, light ash-grey substance in a tourmaline-bearing granite from the Grotto d'Oggi, Elba, was found, on microscopical examination and chemical analysis, to be tourmaline. In the analysis, the loss on ignition represents water and silicon fluoride.

	SiO ₂	Al ₂ O ₃	FeO(MnO)	B ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	Loss on ignition.	Total.
	38.30	37.54	12.20	7.47	trace	0.47	1.42	0.32	3.72	101.44

L. J. S.

Kieselguhr from County Antrim. By JAMES HOLMS POLLOK (*Sci. Proc. R. Dublin Soc.*, 1899, 9, N.S., 33—36).—Deposits of kieselguhr, resting on peat and covered only by vegetation, occur on both banks of the Lower Bann from Toome Bridge, where the river emerges from Lough Neagh, right down to Coleraine at the mouth. At Toome Bridge, the deposit is 4 feet thick. After cutting and drying in the sun, the material is pure white, porous and very light (sp. gr. of the mass, 0.5422). The material is probably now being deposited when the river overflows its banks, the diatoms, which are mostly cubical in shape, being brought down from Lough Neagh. Analyses gave:

	Soluble SiO ₂	Insol. SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	Alka. lia.	Organic matter, comb.	Moisture.	Total.
I.	70.9	—	9.8	5.4	1.5	0.1	—	12.0	—	99.7
II.	57.12	15.89	8.55	2.09	1.14	0.83	0.28	7.71	6.39	100.00

L. J. S.

Illinois Gulch Meteorite. By H. L. PRESTON (*Amer. J. Sci.*, 1900, [iv], 9, 201—202).—This iron was found in 1899, 4 feet below the surface, in Illinois Gulch, Deer Lodge County, Montana. It weighs about 2435 grams, and measures 63 × 104 × 105 cm. No distinct figures are brought out by etching. A little troilite and

possibly some rhabdite are present. Analysis by Mariner and Hoskins gave:

Fa.	Ni.	Co.	Si.	P.	C.	Total.
92.51	6.70	0.16	trace	0.62	0.01	100.00

L. J. S.

Composition and Properties of the Mineral Waters of Australasia. By ARCHIBALD LIVERSIDGE, WILLIAM SKEEY, and G. GREY (*Rept. Australian Assoc. Adv. Sci.*, 1898, 7, 87—108).—A collection of all the available analyses that have been made.

L. J. S.

Physiological Chemistry.

Action of the Blood-gases on Breathing. By W. PLAVEC (*Pflüger's Archiv*, 1900, 79, 195—210).—The difference between the action of deficiency of oxygen and increase of carbon dioxide in the blood is greater than has been supposed. With small carbon dioxide tension in the blood, such as is obtained by breathing air containing 5 per cent. of the gas, there is only an action on the respiratory movements, but with greater tension the respiratory centre is greatly stimulated. The theory of Hermann, that the deficiency of oxygen raises the irritability of the centre to carbon dioxide, has no foundation; in fact, there is a progressive lessening of its excitability. The terminal inspirations of acute asphyxia are caused by the accumulation of carbon dioxide in the blood. The breathing in of this gas causes an increased rate of respiration, and its presence in the blood is the normal stimulus to produce breathing.

W. D. H.

Respiration in the Frog. By J. ATHANASIU (*Pflüger's Archiv*, 1900, 79, 400—422).—The respiratory metabolism in the frog varies greatly with the time of year. The respiratory quotient is in the mean 0.77 in summer, and 0.95 in winter, but in the winter it may exceed unity. The high respiratory quotient apparently depends on reserve of oxygen in the tissues.

W. D. H.

Nitrogenous Metabolism after Splenectomy. By LAFAYETTE B. MENDEL and HOLMES C. JACKSON (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, iii—iv).—In view of the part supposed to be played by the spleen in uric acid formation, it was found that, in cats and dogs, removal of this organ does not lessen the normal output of uric acid, after diets of different kinds. The ability of the organism to form allantoin after ingestion of thymus or pancreatic tissue is in no way diminished.

W. D. H.

Nutritive Value of Alcohol. By WIEBUR O. ATWATER (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xiii—xiv).—Experiments on men show that alcohol serves the body as fuel, as

do fats and carbohydrates. 98 per cent. of the alcohol given was oxidised in the body, and the alcohol supplied about one-fifth of the total energy during rest, and about one-seventh during work.

W. D. H.

Digestion of Carbohydrates by Aplysia. By FRANZ RÜHMANN (*Chem. Centr.*, 1900, i, 50; from *Centr. Physiol.*, 13, 455).—The *Aplysia*, like the *Geophila*, live on the green portions of plants, and those found in the Bay of Naples principally consume the algæ, *Ulva lactuca*, which contains starch, and a pentosan which is soluble in water. By the action of an enzyme in the intestines, the starch is converted into dextrose. Although glycogen was not found in the intestines, the presence of a pentosan identical with that of the algæ was detected.

E. W. W.

Some Comparative Analyses of, and Digestion Experiments with, White and Whole-meal Breads. By OTTO ROSENHEIM and PHILIP SCHIDROWITZ (*Analyst*, 1899, 24, 227—234).—Analyses are recorded of ordinary white bread, ordinary whole-meal bread, and patent whole-meal bread; the figures relating to the two brown breads reveal no striking differences, and although the white bread was somewhat poorer in mineral phosphatic matter and total soluble constituents, its nitrogenous matter, or total, pure, and soluble albumin was about equal to that of the brown samples.

Digestion experiments (salivary, gastric+pancreatic, and pancreatic), conducted *in vitro*, did not accord with the popular belief in the superiority of the brown breads; in fact, white bread is superior as far as digestibility pure and simple is concerned.

L. DE K.

Plasmon. By HEINRICH PODA and WILHELM PRAUSNITZ (*Zeit. Biol.*, 1900, 39, 279—312).—Plasmon is a new preparation from the proteids of milk. The experiments here recorded, which were carried out on human beings, show that it is easily digestible and assimilable, and that its nutritive value is equal to that of meat.

W. D. H.

Assimilation of Iron. By EMIL ARDERHALDEN (*Zeit. Biol.*, 1900, 39, 193—270).—The numerous experiments here recorded on various animals relate principally to the estimation of hæmoglobin. They support the author's previous contention that the iron of inorganic compounds, of hæmoglobin, and of hæmatin in the food, is absorbed and utilised in the manufacture of hæmoglobin.

W. D. H.

Absorption in the Small Intestine. By OTTO COHNHEIM (*Zeit. Biol.*, 1900, 39, 167—172).—The main contention of the argument from the experiments recorded, which consisted chiefly in destroying the epithelium of the small intestine with hot water, is that the living cells play an important selective part in absorption. Höber's contention that the act of absorption is the same in principle in living and dead animals is contested.

W. D. H.

Reduction of Cholesterol to Coprosterol in the Human Intestine. By PAUL MÜLLER (*Zeit. physiol. Chem.*, 1900, 29, 129—135).—Whether the reduction of cholesterol into coprosterol which Bondzynski showed occurred in the intestine is due to putre-

factive organisms or to the normal action of the digestive juices is a matter of doubt. By a pure milk diet, the putrefactive processes in the intestine are reduced to a minimum; under these circumstances, cholesterol is found unchanged in the fæces. The fact that cholesterol is found in meconium, the contents of the foetal intestine (Flint), also points to the bacterial origin of coprosterol.

W. D. H.

Chemical Changes in the Developing Egg. By P. A. LEVENE (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xii—xiii).—The quantity of xanthine bases and nuclein compounds increases with the growth of the egg embryo. The importance of mineral salts increases also. The following table summarises the facts with regard to nitrogen; the numbers given are percentages:

Nitrogen.	Unfertilised	Eggs after fertilisation,		
	eggs.	24 hours.	10 days.	19 days.
In mono-amino-compounds	21.10	21.37	22.72	0
In bases	12.07	25.10	12.48	28.25
In proteids	66.00	53.57	64.79	71.84

W. D. H.

Composition of Hen's Egg. By ADOLF JUCKENACK (*Chem. Centr.*, 1900, i, 304; from *Zeit. Unters. Nahr. Genussmittel.*, 1899, 905—913).—The quantity of phosphorus contained in the ash of yolk of egg does not represent much more than half the amount before incineration, for, owing to insufficiency of bases, a portion of the phosphoric acid is reduced during combustion; it is necessary, therefore, to add sodium carbonate and potassium nitrate before incinerating. An egg contains 0.455 per cent. of phosphorus, the white containing 0.031 and the yolk 1.279 per cent. Of the latter, 0.478 is present as distearyllecithin (5.42 per cent.), 0.345 as the compound of vitellin and distearyllecithin (3.93 per cent.), 0.178 as nucleins, and 0.278 as insoluble phosphates, glycerophosphoric acid or derivatives. The yolk contains 0.91 per cent. of cholesterol.

E. W. W.

Chemical Composition of New-born Children. By WILLIAM CAMERER, jun., and FRIEDRICH SÖLDNER (*Zeit. Biol.*, 1900, 39, 173—192).—The total composition of three new-born children is given, and contrasted with that of human milk.

W. D. H.

Chemico-physical Relations of Animal Juices and Tissues. By MAX OKER-BLOM (*Pflüger's Archiv*, 1900, 79, 111—145).—The electrical conductivity reckoned for a unit column of 1 c.c. offering a resistance of 1 ohm is, at 25°, for defibrinated ox blood, 52.5 to 70.9; for ox-serum, 114.4 to 131.1; for defibrinated pig's blood, 44.5 to 51.5; and for pig's serum, 119.3 to 126.8; for a 0.7 per cent. solution of sodium chloride, it is 124.1, a number approximately equal to that of serum. By diluting blood or serum with distilled water, the conductivity increases much more quickly than that of a 0.7 per cent. solution of sodium chloride with the same amount of dilution. The degree of dissociation of the serum electrolytes is 0.65 to 0.76, and of the blood 0.34 to 0.45. Between 20° and 40°, the conductivity in-

creases with the temperature. No difference was found between arterial and venous blood. The conductivity depends partly on the electrolytes of the corpuscles. W. D. H.

Influence of Iodine, Sodium Iodide, and Iodothyron on the Circulation. By A. G. BARBERA (*Pflüger's Archiv*, 1900, 79, 312—318).—Largely polemical. Laudenbach has found that iodothyron has not the action on the circulation described by von Cyon. He, however, used Notkin's preparation, which appears to be very toxic, whilst von Cyon used Baumann's iodothyron. The latter lowers the blood pressure and the heart rate, whilst Notkin's preparation acts in the opposite way. Iodine and sodium iodide act like Notkin's preparation, stimulating the cardiac accelerators and vaso-constrictors, and depressing the inhibitory nerves of the heart and blood-vessels. W. D. H.

Infusion after Severe Hæmorrhage. By PERCY M. DAWSON (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xxviii).—After removal of large quantities of blood in dogs, infusion with isotonic solutions (normal saline with and without milk, Ringer's solution) was performed. A post-hæmorrhagic fall of red corpuscles continues for from four to eight days. This is not due to osmotic changes in the plasma, but to the low resistance of the remaining corpuscles. With regard to the post-hæmorrhagic leucocytosis which were noted, there is no evidence that the polymorpho-nuclears are formed from the lymphocytes, at any rate in the circulating blood. W. D. H.

Influence of Protoplasmic Poisons on Lymph Formation. By WILLIAM J. GIES and LEON ASHER (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xix—xx).—Experiments were made on dogs with quinine and arsenic. Quinine does not interfere with the usual influence of dextrose, but suppresses the action of leech extract. The action of dextrose as a lymphagogue therefore depends on physical factors, and of leech extract on physiological factors. The effect of sugar is not merely due to increased capillary pressure, for in a dog, after quinine and dextrose, the lymph flow continued for three hours after the animal's death. Arsenic increases the permeability of the vessel walls, but it hardly influences the flow of lymph. Starling's mechanical theory therefore fails. W. D. H.

Bile as a Solvent. By BENJAMIN MOORE (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xiv—xv).—Bile dissolves lecithin and cholesterol. It also dissolves soaps and free fatty acids. This power is due to the bile salts, and is increased by the presence of lecithin in solution. Cholesterol and soaps of calcium and magnesium are only slightly soluble in bile, but are more soluble when lecithin is present also. The sodium soaps are more soluble in bile than in water; the solution is less viscid when bile is present, and, on cooling, the soaps are precipitated in a granular form, not as a jelly. All these facts show the importance of bile in the digestion of fats. W. D. H.

Fat in Cartilage. By CESARE SACERDOTTI (*Virchow's Archiv*, 1900, 159, 152—173).—The fat in cartilage cells is constantly and

normally present. It increases in quantity with the physiological growth of, and diminishes with degenerative changes in, the cells, although in some cases of inanition the lessening of the cartilage fat is not perceptible.

W. D. H.

Hepatic Glycogen during Pregnancy. By ALBERT CHARRIN and A. GUILLEMONAT (*Compt. rend.*, 1900, 130, 673—675).—Experiments on guinea-pigs show that the hepatic glycogen increases during pregnancy, especially as full term approaches. This increase is more marked if sugar is supplied to the animals. The sugar eliminated by the urine is more considerable in gravid as compared with normal animals. The need of the animals for sugar is thus less during pregnancy, and the accumulated carbohydrate is believed to be used up later for the needs of lactation.

W. D. H.

Does Cellulose occur in the Shield of Sepia? By FRIEDRICH N. SCHULZ (*Zeit. physiol. Chem.*, 1900, 29, 124—128).—Ambronn (*Mitt. zool. Station Neapel*, 1890, 9, 475) states that besides chitin, the so-called *Os sepia* contains cellulose. This is stated to be an error.

W. D. H.

The Catechol-like Substance of the Suprarenals. By OTTO VON FÜRTH (*Zeit. physiol. Chem.*, 1900, 29, 105—123. Compare Abstr., 1899, ii, 115).—The active substance in the suprarenal bodies which produces the typical rise of blood pressure is termed *suprarenine*. It is believed to be a hydro-derivative of dihydroxy-pyridine of the composition $C_6H_7O_2N$ or $C_6H_6O_2N$. It may be readily separated as an iron compound, 0.000017 gram of which produces a rise of blood pressure. It differs in its reactions and composition entirely from Abel's epinephrine, which is stated to produce no effect on blood pressure. The suprarenals contain 0.01 per cent. of epinephrine, and from 0.1 to 0.17 per cent. of suprarenine. A very small contamination of the former with the latter would produce a rise of blood pressure.

W. D. H.

Deposits of Uric Acid Artificially Produced in Birds. By E. SCHREIBER and ZAUDY (*Pflüger's Archiv*, 1900, 79, 53—98).—In the course of Ebstein's investigations of the aetiology of gout, he succeeded with hens in producing deposits of urates artificially in the organs and tissues after ligature of the ureters, or injury to the kidneys produced by injection of chromates. These experiments having been called in question, the present work, carried out under Ebstein's supervision, consisted in repeating and confirming them. The deposits, partly crystalline, partly amorphous, were found in the blood, lymph, and among the tissue elements in various organs. Although the view is supported that the uric acid is the source of the irritation in gout, the actual deposition of the urates is considered to occur *post-mortem*, or at earliest in the *ante-mortem* death agony.

W. D. H.

Coagulable Proteids of Connective Tissues. By WILLIAM J. GIES and A. N. RICHARDS (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, v).—In aqueous and magnesium sulphate

extracts of tendon, there are two coagulable proteids; one separates at 54—57°, the other at 73°. Elastic ligaments contain more proteid than tendon, and fractional heat coagulation indicates the existence of as many as five proteids; they also contain a large quantity of creatine.

W. D. H.

Glucoproteids of White Fibrous Tissue. By WILLIAM J. GIES and WILLIAM D. CUTTER (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, vi).—The amounts of nitrogen and sulphur in the mucin obtained in lime-water extracts from the tendo Achillis indicate that there are several members of the group present, and that these are different from those in the tendon sheath. The osazone obtained melts at 182°, but a pure crystalline product was not isolated. Some experiments appear to indicate the possibility of the presence of glucosamine. The differences between mucins, mucoids, and chondro-proteids appear to depend chiefly on the proportions of proteid and acid radicles in them.

W. D. H.

Organic Phosphorus Compounds in Infants' Urine. By ARTHUR KELLER (*Zeit. physiol. Chem.*, 1900, 29, 146—184).—Children fed on mother's milk excrete less phosphorus than those fed on cow's milk. This is not entirely dependent on the amount of phosphorus in the food. Full particulars are given of experiments on numerous infants, healthy and sick, the amount of phosphorus being determined both in organic and inorganic compounds in the urine. The amount of organically combined phosphorus in three healthy children corresponds with 0.00218 to 0.0167 gram of phosphoric oxide, which is more in proportion to body weight than in adults; in relation to total phosphorus, from 0.5 to 9.9 per cent. is in organic combination; in adults, the number is from 1.6 to 4.8 (Oertel). These numbers do not run parallel to the total phosphorus or total nitrogen in either food or excreta. They are, however, parallel to the amount of phosphorus retained in the body. The amount is not influenced by the administration of sodium phosphate, but the organic phosphorus does not come exclusively from the food, but from organs rich in nuclein.

W. D. H.

Elimination of Sodium Cacodylate in the Urine after Administration by the Stomach. By HENRI IMBERT and E. BADEL (*Compt. rend.*, 1900, 130, 581—583).—Sodium cacodylate, when administered by ingestion in quantity amounting to 0.2 gram, has a marked effect in reducing the volume of urine eliminated for three or four days, although this soon returns to its normal amount. The greater part of the cacodylate is eliminated in the urine during the first twenty-four hours, and after this approximately the same minute quantity (0.003 gram) is eliminated each day for about a month, the elimination being then complete.

C. H. B.

Oxidation of Urine. Phenols and Indican. By S. COTTON (*J. Pharm.*, 1900, [vi], 11, 59—61. Compare Abstr., 1899, ii, 780).—The oxidation product of indican, the formation of which is used as a test for this substance in urine, may be obtained from urine as follows: The urine is distilled with 1/20th of its weight of nitric acid until 40

per cent. has distilled over, the distillation being effected, as far as possible, out of contact with air. The solid carbonaceous residue in the flask is collected and treated with light petroleum to remove benzoic acid, &c., and then extracted with chloroform, which dissolves out the oxidation product of indican, and on evaporation yields it in the form of coloured, prismatic crystals.

The first portion of the distillate, obtained as above, contains benzoic acid, and the latter portions, a phenol derivative which forms a red crystalline potassium salt.

H. R. LE S.

Physiological Action of Tellurium Compounds. By WILLIAM J. GIES and L. D. MEAD (*Proc. Amer. Physiol. Soc.* Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xx—xxi).—In dogs, small doses (0.1 gram daily) of tellurous oxide, sodium tellurite, and tellurium tartrate have no effect on metabolism. Tellurium is eliminated in the urine and faeces, and the odour of methyl telluride in the expired air is pronounced. Larger doses (0.2 to 0.5 gram) cause violent vomiting, disintegration of the gastric mucous membrane, interference with the secretion of hydrochloric acid, and regurgitation of bile. Under 1 per cent. of tellurium tartrate and sodium tellurite does not hinder artificial peptic or tryptic digestion. When tellurium compounds come in contact with tissue cells, reduction to the metallic state occurs, although tellurium itself is soluble in the body juices. Thus tellurium was recovered from liver, kidneys, bile, and brain, but most from the tissues about the point of injection.

W. D. H.

Behaviour of Chitosamine [Glucosamine] Hydrochloride in the Animal Organism. By THEODOR R. OFFER and SIGMUND FRÄNKEL (*Chem. Centr.*, 1900, i, 211; from *Centr. Physiol.*, 13, 489—491).—The urine of men or dogs fed with glucosamine hydrochloride showed distinct reducing properties and was dextrorotatory. By determining the rotatory power, it was found that when doses of 10—20 grams were administered to dogs *per os*, 20 per cent. of the glucosamine hydrochloride was excreted in the first seven hours, and that after this time the urine became optically inactive. Similar results were obtained by subcutaneous injection. Glucosamine may be separated from the urine as the benzoate.

E. W. W.

Study of the Relationship between the Chemical Constitution of Alkylated Alkaloids and their Physiological Action. By WLADIMIR ROSENSTEIN (*Compt. rend.*, 1900, 130, 752—755).—The following alkaloid salts, basic cinchonine hydrochloride, and the hydrochlorides of methylecinchonine, dimethylecinchonine, cinchotoxine and methylquinine, produce tetanic and epileptic convulsions, whereas the salts of the corresponding quaternary bases, namely, cinchonine and methylecinchonine methochlorides, dimethylecinchonine benzochloride, cinchonine dimethochloride, and quinine and methylquinine methiodides have a paralysing action; moreover, the toxic effect of the latter series is always much greater than that of the former.

No definite relationship can be traced as to effect of alkylation on the physiological action of the alkaloid; cinchotoxine and its

N-methyl derivative, methylcinchonine, have the same effect, whereas methylquinine differs from quinine in being a highly poisonous base. The curarising action of the second series of salts seems to be due to the molecular configuration peculiar to quaternary bases.

G. T. M.

Suprarenal Extracts. By BENJAMIN MOORE and C. PURINTON (*Proc. Amer. Physiol. Soc.*, Dec. 1899; *Amer. J. Physiol.*, 1900, 3, xv, xvi—xvii).—In the dog, injection of extracts of suprarenal medulla in doses varying from 0.24 to 24 millionths of a gram per kilo. of body weight produces marked results. The minutest doses produce a fall instead of a rise of blood pressure. This is considered to be due to the action of the same active substance, not to admixture with a second material. The results show that any activity possessed by the substances hitherto isolated from the suprarenal may be explained by slight contamination with the unaltered active principle. In separating the active substance, the use of alkali should be avoided. The presence of the chromogen must not be taken alone to indicate the presence of active material. A new colour reaction of the chromogen is described, namely, dilute ferric chloride after excess of zinc acetate gives an evanescent, deep violet colour, which, in strong solutions, leaves a violet precipitate.

W. D. H.

A Depressor Substance in the Suprarenal Gland. By R. HUNT (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xviii—xix).—After epinephrine has been removed from an aqueous extract of suprarenal by means of benzoyl chloride, a substance remains which produces a fall of blood pressure. By both chemical and physiological properties, this substance is found to be choline. Extracts of sympathetic ganglia and brain contain choline also.

W. D. H.

Mucin. By I. LEVIN (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xxix—xxx).—Thyroidectomy causes auto-intoxication from the accumulation of mucin in the blood. Injection of mucin in sodium carbonate has no effect on healthy rabbits, but is fatal to those without a thyroid. In dogs, it causes a fall of blood pressure due to its action on the vasomotor centre.

W. D. H.

Metabolism in Pernicious Anæmia. By WAŁAW VON MORAWIEWSKI (*Virchow's Archiv*, 1900, 159, 221—247).—Observations were made on four patients suffering from pernicious anæmia. In the simple anæmia, a noteworthy feature of the metabolism is a retention of chlorine. From the cases now recorded, the characters of the metabolism are so marked as to assist diagnosis. They are, a relatively large excretion of chlorine, an absolute loss of calcium, and a small excretion of both nitrogen and phosphorus.

W. D. H.

Multiple Amyloid Tumours in the upper Air Passages. By PAUL MANASSE (*Virchow's Archiv*, 1900, 159, 117—136).—Some cases of multiple tumours in the upper air passages are recorded, with full clinical and microscopical details. The substance of the tumours, which, in an early stage, appeared to be sarcomatous, was later found, from

its microscopic appearance and reaction with iodine, to be amyloid, or lardacein. From the history of the cases, and the examination after death, it is regarded as probable that the amyloid substance is formed within the lymphatic vessels and canaliculi, and that the infiltration of the connective tissue is secondary to this.

W. D. H.

Occurrence of Lactic Acid in the Animal Organism in Reference to Arsenical Poisoning. By KURATA MORISHIMA (*Chem. Centr.*, 1900, i, 45; from *Arch. exp. Path. Pharm.*, 43, 217—244).—Sarcrolactic acid occurs in the liver of all animals, and is also found in the kidneys, the coat of the stomach, and the blood. After death, the quantity of lactic acid in the liver increases as the glycogen decreases, fermentation lactic acid, however, being mainly formed. In cases of poisoning by arsenious oxide, the consequent rapid disappearance of glycogen in the liver is accompanied by the formation of a large quantity of paralactic acid in this organ, and also in the blood. Arsenical poisoning also causes an even larger increase of lactic acid in the kidneys than in the liver.

E. W. W.

Toxicology of Potassium Chlorate. By S. J. MELTZER (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, ix—x).—Potassium chlorate does not cause death by changes in the blood. Death often supervenes before the blood is altered, and the formation of methæmoglobin within the vessels is comparatively harmless. Death results from paralysis of inspiratory muscles. Intracerebral injection shows it is a poison to nerve-cells, first exciting, then paralyzing them.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Fermentation of Yeast. By CARL J. LINTNER (*Chem. Centr.*, 1900, ii, 54; from *Centr. Bakt. Parasit.*, 5, ii, 793—800).—Chlorides check the fermentation of yeast, whilst the action of sulphates depends on the base. Zinc, magnesium, and ferrous sulphates, and potassium hydrogen phosphate promote the fermentation, whilst copper, and, still more, manganese sulphate, disodium phosphate, ammonium salts, and perhaps nitrates retard it. Saturated, and in some cases super-saturated, solutions were employed.

The fermentation of yeast diminishes gradually, as the reserve substances are consumed. By adding sodium sulphate, which induces vigorous fermentation, to yeast, it would be possible to ascertain whether the yeast is fresh, or whether it has been kept for some time; but this is not thought to be of practical importance.

The effect of salts may be due to abstraction of water, by which the plasma would be stimulated; excessive abstraction of water (by chlorides) would act deleteriously.

N. H. J. M.

Formation of Alcohol in the Putrefaction of Proteids free from Carbohydrates. By DIOSCORIDE VITALI (*Chem. Centr.*, 1900, i, 141—142; from *Boll. Chim. Farm.*, 38, 729—734).—Alcohol was found amongst the products formed by allowing horse muscle, from which the fat and sugar had been completely removed, to putrefy in presence of water at 28—32° from July to December. Blumenthal and Mayer (*Abstr.*, 1899, i, 968) have observed the formation of a hexose from albumin, and the glucoproteids or compounds of the simpler proteids, such as albumin or globulin with carbohydrates, also yield sugars which may be fermented. According to Gautier and Étard (*Abstr.*, 1882, 1115), the putrefaction and fermentation of muscular tissue takes place in two periods, an acid reaction obtaining in the first period, and an alkaline reaction in the second; the formation of alcohol takes place in the latter period. The bacteria which cause putrefaction are also capable of producing alcoholic fermentation. Experiments have been made with mucin, a glucoproteid found in considerable quantities in snails; the fresh aqueous extract was neutral, but on keeping became, first, acid, then, after a time, again neutral, and finally, in 2—3 months, acquired a faint alkaline reaction. True putrefaction had not, however, commenced, and consequently alcohol had not been formed. E. W. W.

Acetic Bacteria. By W. HENNEBERG (*Bied. Centr.*, 1900, 29, 66—67; from *Centr. Bakt. Parasit.*, 4, ii, 14, 67, and 138).—In addition to the two new varieties previously described (*Bied. Centr.*, 28, 647), a third (*Bacterium acetigenum*) has been found.

As regards temperature, it was found that in the case of five varieties (excluding *B. acetigenum*), the production of acetic acid is very slight at 33°, but is considerable at 26—29°, and (with the exception of *B. acetosum*) at 15° again very slight.

The degree of acidity produced, under conditions as favourable as possible, by the different varieties was as follows: *Bacterium oxydans*, 2; *B. acetigenum*, 2.72; *B. acetosum*, *B. aceti*, and *B. Kützingerianum*, 6.6; and *B. Pasteurianum*, 6.2 per cent.

The highest percentage of alcohol in which acetic acid can be produced varies a good deal. The limit is lowest in the case of *B. acetigenum* (less than 5 per cent.); with *B. oxydans*, it is 7; with *B. Kützingerianum*, and *B. Pasteurianum*, 9.5; and with *B. acetosum* and *B. aceti*, 11 per cent. None of the six varieties develops in beer to which 3—6 per cent. of acetic acid has been added.

N. H. J. M.

Effect of different Substances on the Curdling of Milk. By THOMAS BOKORNY (*Bied. Centr.*, 1900, 29, 62—65; from *Milchzeit.*, 1898, No. 49, 769).—Certain poisons, such as 0.01 per cent. solutions of hydroxylamine hydrochloride, formaldehyde, and menthol, which act strongly on putrefying bacteria, have no, or very little, effect on the lactic acid bacillus. A number of experiments were made in which various substances were added to milk, which was then kept at the temperature most favourable to curdling (26—27°). Milk alone curdled in 24 hours. In the following summary of results, the time required for curdling is given after each substance. Oil of turpentine

(1:75000), 48 hours; menthol (0.01 per cent.), 48 hours; eugenol (0.005 per cent.), 24 hours; cinnamaldehyde (0.005 per cent.), 24 hours; *p*- and *o*-hydroxybenzaldehydes (0.05 per cent.), after 48 hours; *p*- and *o*-hydroxybenzoic acids (neutralised, 0.05 per cent.), within 48 hours; *p*- and *o*-cresols (0.05 per cent.), 48 hours; paraldehyde (0.1 per cent.), 24 hours; salicylaldehyde (0.1 per cent.), 48 hours; carvol (0.05) and cuminaldehyde (0.005 per cent.), 24 hours; salicylic acid (0.2 per cent.), 3 days; heliotropin (0.1 per cent.), 24 hours; formaldehyde (0.002 per cent.), 24 hours; (0.01 per cent.), 3 days; (0.1 per cent.), no curdling in 6 days.

Silver nitrate (0.001 per cent.), 48 hours; (0.01—0.1 per cent.), 4 days; (0.2 per cent.), no curdling in 6 days; hydroxylamine hydrochloride (0.1 per cent.), 48 hours; boric acid (0.1—0.2 per cent.) has scarcely any appreciable effect according to Lazarus. Sodium carbonate (0.3 per cent.), no effect (Lazarus in *König's Nahrungsmittel*, 2, 244). Calcium hydroxide (0.15 per cent.) has no effect, and borax (0.4 per cent.) very little effect on bacteria (Lazarus). Hydrogen peroxide (0.1 and 1.0 per cent.), 3 days.

N. H. J. M.

Denitrification and Fermentation. By KURT WOLFF (*Chem. Centr.*, 1900, i, 52—53; from *Hygien. Rundsch.*, 9, 1169—1172. Compare this vol., ii, 98).—The bacteria employed in these experiments were four of the typhus-like bacilli (including *B. coli commune*, and Löffler's mouse typhus bacillus), and two hay bacilli (one apparently *B. Fitzianus*, from ginger root, the other from meal). All the bacilli reduced nitrates to nitrites in 1 per cent. dextrose broth containing 0.05—0.23 per cent. of potassium nitrate; but the extent of the reduction varied very much with the different bacilli; the coli-like bacilli reducing least, the hay bacilli the most, nitrate. Only one of the latter (of all six bacilli) can be compared with the real denitrifying organisms. The strength of the sugar solution was without influence, but the amount of nitrate present had a decided effect; an excess of nitrate checks fermentation, without, however, otherwise disturbing the functions of the bacilli; and complete disappearance of nitric nitrogen can only take place simultaneously with fermentation.

It is concluded that denitrification is not due to the direct action of the microbes, but that the products of fermentation reduce nitrates to nitrites and eventually convert them into carbonates.

Any fermentation of sugar, by whatever microbes it is caused, will, it is believed, destroy nitrates when present, and denitrification can only take place in presence of substances which yield denitrifying products of metabolism.

N. H. J. M.

Inoculation with Nitragin. By BERNHARD FRANK (*Landw. Versuchs.-Stat.*, 1899, 51, 441—445).—At the suggestion of the Prussian Agricultural Department, pot and field experiments with nitragin were made in 1896—1897, at twelve Experiment Stations. Positive results were only obtained at four of the twelve. The negative results are attributed to there being sufficient abundance of leguminous nodule bacteria already in the soil.

It is, however, pointed out that negative results were obtained on uncultivated land where the application of inoculating soil had proved to be at once effective. In such cases, the failure of nitragin is thought to be due to the cultivations being weak, and it is suggested that if the gelatin of nitragin were to be replaced by some substance more similar to the natural media of the nodule bacteria, better results might be obtained.

N. H. J. M.

How can the Action of Nitragin be Increased? By FRIEDRICH NOBBE and LORENZ HILTNER (*Landw. Versuchs.-Stat.*, 1899, 51, 447—462).—A reply to Frank (preceding abstract). It is stated, in the first place, that subsequent experiments made at the Prussian Experiment Stations in 1897—1898 have given more satisfactory results than the previous ones.

As regards the employment of gelatin, reference is made to earlier experiments, the results of which showed that gelatin cultivations were extremely vigorous. In some cases, inoculation of seedlings growing in absence of combined nitrogen, resulted in injury to the plant, owing to the vigour of the cultures; in presence of a little combined nitrogen, the gelatin cultures proved to be better than direct inoculation from nodules, production of active nodules being much quicker.

As regards the application of nitragin, dilution with distilled water may completely kill the bacteria, and even well-water may be injurious. It is thought that the extract of glycyrrhiza roots, known as "Lakritzen," might be advantageously employed. This could not, of course, be utilised in cultivating the bacteria, as they would all gradually become converted into the glycyrrhiza modification.

When seeds are inoculated, they should be allowed to swell before being sown. In the case of soil inoculation, the material may be added to a mixture of soil and finely cut leguminous hay; the mixture is sown over the land, not with the seed, but some weeks later, if possible in rainy weather.

N. H. J. M.

Action of Moulds on Arsenic and its Compounds. Biological Proof of the Presence of Arsenic. By RUDOLF ABEL and PAUL BUTTENBERG (*Chem. Centr.*, 1900, i, 428—429; from *Zeit. Hyg.*, 32, 449—490).—In the original paper, the part played by moulds in reference to arsenical poisoning caused by wall papers containing arsenic is discussed. Of the various microbes, the development of the moulds is least retarded by the presence of arsenious acid, and of 40 kinds which were examined, 10 were found to be capable of decomposing this acid and forming arsenical vapours. *Penicillium brevicarule* gave the best results (compare Gosio, *Abstr.*, 1897, ii, 381). The presence of 0.01, and often even of 0.001 mg. of arsenic may be detected by the arsenical odour produced by raising a strong culture of the mould in the presence of a soluble or insoluble substance containing arsenic. The conditions necessary, and the use of this method, in comparison with the ordinary chemical methods, are discussed in the original paper.

E. W. W.

Influence of the Temperature of Liquid Hydrogen on the Germinative Power of Seeds. By SIR W. THISELTON-DYER (*Proc. Roy. Soc.*, 1899, 65, 361—368. Compare BROWN and ESCOMBE, *ibid.*, 62, 161).—Various seeds which had been cooled to -250° , in one case in a vacuum, in another case by immersion in liquid hydrogen, showed no alteration in appearance, and germinated well. The question whether the temperature of the seeds actually reached that of the liquid hydrogen is discussed; in the case of the seeds immersed for more than six hours, there would seem to be no room for doubt.

N. H. J. M.

Changes in the Organic Constituents of the Seed during Germination. By GUSTAVE ANDRÉ (*Compt. rend.*, 1900, 130, 728—730. Compare this vol., ii, 159).—The amount of total nitrogen present in the seedling of *Phaseolus multiflorus* from the commencement of germination to the period at which the dry weight of the young plant is again equal to that of the seed is fairly constant.

On extracting the seedling with dilute acetic acid, the asparagine passes into solution as ammonium aspartate; the extract is rendered alkaline and distilled, the ammonia evolved being a measure of the asparagine present in the seedling; acetic acid also dissolves other amides which are not affected by the alkali. The amounts of asparagine and soluble amides attain their maxima when the dry weight of the seedling reaches its minimum; from this stage onwards, it appears that the soluble amides are utilised in the production of the insoluble proteid material of the young plant.

The soluble carbohydrates are extracted with warm 60 per cent. alcohol, hydrolysed by dilute acid, and estimated as reducing sugar; the amount of these substances is greatest in the seed and decreases continuously during germination.

The quantity of starch and hydrolysable cellulose diminishes rapidly during germination; on the other hand, the proportion of non-hydrolysable cellulose increases greatly, and when the seedling has regained its original weight, the increase is twofold. At the close of the period under examination, the amounts of cellulose and mineral constituents increase very rapidly, and there seems to be an intimate relation between the development of cellulose and the absorption of lime and silica. The analytical results are exhibited in tabular form.

G. T. M.

Digestion of the Reserves in Seeds during Germination and their Assimilation by the Seedlings. By PIERRE MAZÉ (*Compt. rend.*, 1900, 130, 424—427. Compare Abstr., 1899, ii, 607).—The production of alcohol and carbon dioxide in germination indicates that the weight of a plant just after germination, from an amylaceous seed, should represent about half the loss in the cotyledons. As germination proceeds, the relation should diminish, since there is also a loss due to construction in addition to the increasing loss due to maintenance. In accordance with this view, it was found that in the germination of peas and haricots, the relation of the weight lost by

the cotyledons to the weight of the seedlings was about 2 after 5—6 days, and increased to 2·3—2·4 at the end of 15—20 days.

Oleaginous seeds, or seeds with mixed reserves, give totally different results. The amount of carbon dioxide given off in 8 days was, however, about the same for *Arachis*, maize (which contain respectively 53·7 and 4·8 per cent. of ether extract), and haricots. It is thought that the conversion of fatty acids into sugar does not depend on the nature of the acid (compare Maquenne, Abstr., 1899, ii, 171); in the case of some oleaginous seeds, the sugar is utilised in constructing or maintaining the cells as soon as it is formed. The digestion of the oil in *Arachis* is thus comparable with that of starch in haricots or peas. *Ricinus*, on the other hand, accumulates sugar, and thus resembles the *Gramineæ*.

The transformation in oily seeds of the group CH_2 into $\text{CH}\cdot\text{OH}$ seems to be as general as the degradation of starch; it is shown to be due to a diastase.

N. H. J. M.

Accumulation of Asparagine in Leguminous Plants cultivated with Insufficient Light. By ÉMILE BRÉAL (*Ann. agron.*, 1900, 26, 5—19. Compare Prianischnikoff, Abstr., 1899, ii, 787).—It was found that when lupins were grown with insufficient light there was an accumulation of asparagine during the last months of the year, the dry matter of the stems and roots (when the plants were 25 cm. high) containing as much as 50 per cent. of asparagine. The nitrogen of the dry matter was 8 per cent., 6 per cent. being in the form of asparagine.

At the time when the stems had reached the length of 20 cm., the plants were still green. The dry matter of the plants weighed less than that of the seeds, and the loss amounted to 36 per cent.

Blue lupins were grown in nutritive solutions containing minerals alone and minerals with potassium humate. By the time the stems were 15 cm. long, the plants without humate had lost 31 per cent. of the dry matter of the seed, whilst those with humate lost 27 per cent.

Subsequent experiments with blue lupins grown in better light showed a gain in weight of dry matter, instead of a loss, and the percentage of asparagine was 4 to 15 in the dry matter.

Lentils, without the cotyledons, grown in solutions of starch, caused a loss of starch in the solutions, and the plants developed better when supplied with starch in addition to minerals than with minerals alone; white lupins were much benefited by potassium humate (compare this vol., ii, 35).

N. H. J. M.

Carbohydrates in the Reserve Material of Lucerne and Fenugreek Seeds. By ÉMILE BOURQUELOT and HENRI HÉRISSEY (*Compt. rend.*, 1900, 130, 731—733. Compare Abstr., 1899, i, 839 and 840).—The pulverised seeds of lucerne are macerated in a solution of lead acetate; after removing the excess of lead from the extract by oxalic acid, the carbohydrate present in the filtrate is precipitated by the addition of alcohol. The product is optically active; $[\alpha]_D +84\cdot26^\circ$ (compare Müntz, Abstr., 1882, 709); on hydrolysis with dilute sulphuric acid at 110° , it yields a mixture of mannose (Abstr., 1899, ii, 817) and galactose; the carbohydrate is accordingly

a mannogalactan. A similar substance is also obtainable from the seeds of fenugreek. The two carbohydrates differ somewhat in composition and properties, but are both hydrolysed by seminaase, with the production of reducing sugars.
G. T. M.

Presence of Dextrose and Lævulose in Beet Leaves. By LÉON LINDET (*Ann. agron.*, 1900, 26, 103—113. Compare Brown and Morris, *Trans.*, 1893, 63, 604; Maquenne, *Abstr.*, 1896, ii, 328; and Lobry de Bruyn and Alberda van Ekenstein, *ibid.*, i, 116).—The different parts of new leaves on beet developed in darkness, as well as in presence of light, were separated, the juice expressed, and the sucrose, dextrose, and lævulose determined. Determinations were also made in normal leaves from the beginning of July to the beginning of October, and in the large and new leaves at different dates from July 17—26.

In the case of etiolated leaves, sucrose is withdrawn from the roots and inverted. Respiration in the leaves is feeble, whilst the production of cellulose is active; in every case, the amount of lævulose is less than that of dextrose. Analogous results were obtained with roots from which the leaves had been removed, and which produced fresh leaves under the influence of light.

As regards the amounts of dextrose and lævulose in the different parts of the leaves, the results showed relatively less dextrose in the parts in which respiration is least active. Comparing the new and the old leaves on the same roots, the new leaves invariably contained relatively less lævulose to dextrose than the old ones; and the question arises whether the better utilisation of lævulose by the plant is not correlative with the production of vegetable tissue (compare Durin, *Ann. agron.*, 1876, 220). It would seem that the vegetable cell selects each sugar for a different function. Certain yeasts attack lævulose in preference to dextrose, others, dextrose rather than lævulose.
N. H. J. M.

Ash of a Coccoanut. By F. BACHOFEN (*Chem. Zeit.*, 1900, 24, 16).—The husk, inner shell, kernel, and milk yielded respectively 1.63, 0.29, 0.79, and 0.38 per cent. of ash.

Each of the ashes were fully analysed, and the results are communicated in tables. The ashes of the inner shell and kernel are richest in phosphoric acid and potassium.
L. DE K.

Plasmolysis. Determination of the Toxicity of Alcohols. By ALB. J. J. VANDEVELDE (*Chem. Centr.*, 1900, i, 481; from *Hand. v. III. Vlammsch Nat. Geneskskundig Congres. Antwerp*, 1899).—The poisonous effects of various alcohols have been measured by experiments on the cells of the red onion, which are rich in anthocyanin and readily exhibit plasmolysis. The poisonous nature of the monohydric alcohols increases with the molecular weight, thus amyl alcohol is about twice as poisonous as isobutyl alcohol, and much more poisonous than ethyl alcohol. Normal propyl alcohol is more poisonous than isopropyl alcohol. The aqueous solutions of the alcohols are usually about twice as poisonous as the alcohols themselves. The older cells withstand the action of the alcohols better than the younger.

E. W. W.

Toxic Action of a Series of Acids, and of their Sodium Salts on *Lupinus Albus*. By RODNEY H. TRUE (*Amer. J. Sci.*, 1900, [iv], 9, 183—192).—Toxic action may be due to the anions, the cations, or the undissociated molecules. In the case of hydrochloric, hydrobromic, nitric, and other inorganic acids, the anions are only slightly toxic compared with the H^+ ions; the toxic value of the sodium salts of these acids is low. In the case of organic acids, the undissociated molecules have considerable toxic action, often exceeding that due to the H^+ ions; in cinnamic acid solutions, for example, the undissociated molecules are credited with 77 per cent. of the total toxic action; the anions of organic acids have in general a low toxic value. J. C. P.

Cultivation of Wheat and Oats at Grignon. By PIERRE P. DEHÉRAIN (*Ann. agron.*, 1900, 26, 20—33. Compare Abstr., 1899, ii, 243).—The results of experiments with large and small wheat grain showed that the larger seeds gave a decidedly greater yield, but the difference was not so marked as might be expected from previous results. Of greater importance is the place of wheat in a rotation, and at Grignon a clover crop was found to be a bad preparation for wheat, perhaps owing to the abstraction by the clover of water from the subsoil.

As regards the best place for oats in a rotation, no very definite conclusion is drawn from the results of the experiments. The greatest yield was obtained after beet, but to grow oats after beet would put wheat after clover, which is undesirable. If potatoes are grown in the place of roots, it is better to grow oats after wheat than after barley, especially if the wheat is succeeded by vetches to be ploughed in. N. H. J. M.

Experiments on Meadows. By BRIGHETTI (*Bied. Centr.*, 1900, 29, 23—26; from *Stas. sper. agrar. ital.*, 1898, 31, 620).—Analyses were made of the herbage from 15 meadows on alluvial soil in Ferrara. The results of botanical separations into gramineous, leguminous, and miscellaneous herbage are also given.

The percentage of proteids is highest in hay containing the most leguminous and leafy plants. The *Leguminosae* predominated under the influence of phosphatic manures, whilst the unmanured land, and that which received compost, produced the most grass.

N. H. J. M.

Vegetation of some Fodder Plants. By MONVOISIN (*Ann. agron.*, 1900, 26, 77—103. Compare DehéRAIN and Bréal, Abstr., 1882, 419; DehéRAIN and Meyer, *ibid.*, 1883, 493; and Villard and Bœuf, *ibid.*, 1898, ii, 181).—Experiments were made with a number of plants to ascertain whether the laws found by DehéRAIN and Bréal in the case of annuals also hold good in the case of plants of longer life.

The amount of root is always high in relation to the stems; it is greatest at the beginning, and is always greater than is the case with annuals.

When the period of maturation has passed, there is a distinct loss

of dry matter. The roots contain more ash than the stems; the maximum amount of ash in the entire plant is not at the beginning of vegetation, or at the flowering period, but between the two. Plants of more than annual growth contain more ash than annuals.

The maximum amount of total nitrogen, like that of ash, was found towards the end of April; afterwards the amounts diminish regularly. Leguminous roots contain more nitrogen than those of the *Gramineæ*. Nitrogen as non-proteid is relatively most abundant at the beginning of vegetation.

N. H. J. M.

Analyses of Norwegian Hay. By FR. WEERENSKIOLD (*Bied. Centr.*, 1900, 29, 19—22; from *Tids. Norsk. Landbr.*, 1899, 6, 35—43 and 82—85. Compare Abstr. 1897, ii, 187).—Further analyses of hay from various parts of Norway. Hay from peat land in Vegusdal, where cattle suffer a good deal from weak bones, contained only 2.86—3.82 per cent. of ash; its injurious effect may, however, be partly due to the small amounts of digestible proteids (three samples out of five contained only 1.08—2.26 per cent.).

Analyses of a number of single plants from Nordland are given.

N. H. J. M.

[Experiments on Sugar-cane in Hawaii.] By WALTER MAXWELL (*Chem. Centr.*, 1900, ii, 357).—Phosphates had practically no effect in increasing the yield of sugar, whilst potash and nitrogen increased the yield by 14 per cent. when employed singly and still more when employed together.

Analyses of the soil and of different parts of the plants are given in the original paper (Honolulu, 1899).

N. H. J. M.

Cultivation of Blue Lupins. By PIERRE P. DEHÉRAIN and E. DEMOUSSY (*Compt. rend.*, 1900, 130, 465—469. Compare this vol., ii, 238).—Blue lupins cannot themselves utilise elementary nitrogen. They may, however, grow normally when their roots are free from nodules; in this case, nitrogen is fixed by bacteria in the soil, associated with algæ (*Phormium autumnale* and *Ulothrix flaccida* were found in about equal amounts). Lupins also grow normally both in acid and in alkaline soil when provided with root nodules containing microbes which fix free nitrogen; in some cases, the nodule bacteria act as parasites, causing the plants to fail.

Arable soils do not generally seem to contain nodule microbes suitable for blue lupins; the microbes are, however, common in heath soil. Arable soil, can no doubt, be made available for blue lupins by inoculation.

N. H. J. M.

Manurial Experiments with Potatoes. By B. SJOLLEMA (*Bied. Centr.*, 1900, 29, 13—14; from *J. Landw.*, 1899, 47, 103).—Field experiments have been made on peat land at Groningen from 1881—1897, on potatoes alternated with cereals (generally oats). The greatest yield of potatoes (31,600 kilos.) was obtained with farm-yard manure, but the percentage of starch (14.25) was lower than with complete minerals and nitrate (31,500 kilos. with 16.15 per cent. of starch). Sodium nitrate (with complete minerals) gave better results than ammonium salts, both as regards total yield and per-

centage of starch. Complete minerals alone gave the highest percentage of starch (16·45), whilst the yield of tubers was 27,800 kilos. ; with potash alone, the yield was 24,150 kilos., and the percentage of starch 16·2 ; with phosphoric acid alone, the yield was 9160 kilos., and the starch 15·5 per cent. Addition of nitrate and lime to phosphate and to potash respectively increased the yield of tubers considerably, but lowered the percentage of starch. With complete minerals, nitrate increased the production of tubers without very appreciably diminishing the amount of starch.

The unmanured plots gave 8900 kilos. of potatoes containing 14·8 per cent. of starch.

Farmyard manure continued to act for three years, whilst artificial manures acted as much as dung for at least one year.

N. H. J. M.

Influence of Chlorides and other Compounds present in the Crude Stassfurt Salts on the Composition and Yield of Potatoes. By B. SJOLLEMA (*Chem. Centr.*, 1900, ii, 360 ; from *J. Landw.*, 47, 305—307).—The injurious effect of Stassfurt salts on potatoes is attributed exclusively to the chlorides present. Potassium, sodium, and magnesium chlorides diminish about equally the percentage of starch, especially in varieties of potato rich in starch. The effect is very marked when 1250 kilos. of kainite are applied in the spring.

Potassium sulphate and “potash magnesia” applied to soils which require potash for potatoes are favourable rather than unfavourable to starch production. The tubers contain about the same amount of potash, whether applied as sulphate or as potassium salts containing chlorides.

The diminished production of starch under the influence of chlorides is partly due to the absorption of water being increased. The amount of potash in the dry matter of the tubers is then much higher than when potassium sulphate is employed, the excess of potash being in the form of chloride.

Soda, even when applied in large amounts, is not taken up by potatoes. Sodium and magnesium sulphates are not injurious, but seem to increase both the yield of tubers and the percentage of starch ; they also reduce the amount of potash in the tubers.

Spring manuring with potassium salts containing much chloride diminishes the yield of potatoes, and still more the percentage of starch, the favourable effect of potash being considerably more than counterbalanced by the injury due to chlorides.

N. H. J. M.

Injurious Effect of Sodium Nitrate on the Growth of Sugar Beet. By JULIUS STOKLASA (*Chem. Centr.*, 1900, ii, 360—361 ; from *Zeits. Zucker-Ind. Böhm.*, 24, 131—146. Compare Sjollema, *Abstr.*, 1897, ii, 585 ; and Zaharia, *Abstr.*, 1899, ii, 799).—The toxic equivalent (expressed as fractions of the mol. weight in grams per 100 c.c.) of potassium perchlorate was determined for different plants at different periods of growth. For sugar beet, potassium perchlorate is not such a strong poison as copper and zinc sulphates, and sodium nitrate containing 2 per cent. of perchlorate has no effect on seed-

lings of sugar beet when the concentration did not exceed 1/10000 of the mol. weight (grams) per 100 c.c. It is thought that 200—500 kilos. per hectare of sodium nitrate containing 2 per cent. of perchlorate could be applied without injury to beet.

The toxic equivalents for rye, oats, and barley (or wheat) were found to be 1/10000, 1.5/10000, and 2/10000 respectively. Assuming the upper 20 cm. of soil to contain as little as 5 per cent. of water (which would only be in dry, summer periods), 100 kilos. of sodium nitrate with 1 per cent. perchlorate would give a concentration of 0.001 per cent., an amount insufficient to injure rye. With more sodium nitrate, or with a higher percentage of perchlorate than 1, rye is distinctly affected. For oats and barley (or wheat), the nitrate may contain 1.5 and 2 per cent. of perchlorate when the amount applied is 100 kilos. per hectare.

N. H. J. M.

Effect of Rain and of the Nature of the Soil on the Production of Crops. By AIMÉ PAGNOUL (*Bied. Centr.*, 1900, 29, 16—19; from *Ann. agron.*, 1899, 25, 83).—Pot experiments are described in which *Festuca pratensis* and incarnate clover were grown in light soil, loam, and calcareous soil respectively. One set of pots received rather less water than would have been the case if exposed to rain, whilst the second set received twice the amount given to the first. From the results, the following conclusions are drawn:

Gramineæ yield about three times, clover almost four times, as much produce in wet as in dry weather. The effect of the greater amount of water was greatest with loam, and least with calcareous soil. Loamy soil gave the smallest yield both of grass and clover, whilst the light soil (which contained 11.85 per cent. of calcium carbonate and 0.462 per cent. of phosphoric acid) gave the best yields.

The plants which received the smaller amount of water contained the greater percentage of dry matter, although the total dry matter was less. The percentage of nitrogen in dry matter was lowest in the plants grown in loam; the total nitrogen was almost twice as high in the case of the plants which received much water as compared with those which had the smaller amount of water.

A second cutting of *Festuca* gave similar results. Subsequently, the same amounts of water were given to all the plots, with the result that the yields became much more alike; the effect of the differences in the previous watering was, however, still noticeable, especially in the case of the loamy soil.

N. H. J. M.

Utilisation by Plants of the Potash Dissolved in the Water in Soil. By TH. SCHLÖSSING, jun. (*Compt. rend.*, 1900, 130, 422—424. Compare Abstr., 1899, ii, 119).—The potash dissolved in soil has, like the phosphoric acid (*loc. cit.*) a considerable nutritive value for vegetation, notwithstanding its relatively small amount; the three or four million kilos. of soil, representing a hectare, contain 1, 2, or 5 kilos. of dissolved potash.

In experiments with maize grown in sand, it was found that a solution containing 7.5 parts of potash per million, in addition to

other minerals in suitable quantity, enabled the plants to grow normally, whilst with a solution containing the same amounts of other minerals, but only 1·8 per million of potash, very much less growth was obtained, and the plants produced no fruit. Maize plants can therefore thrive when they have to depend on solutions containing only some millionths of potash.

N. H. J. M.

Injury to Agricultural Land on the Coast of Essex by the Inundation of Sea-Water on November 29th, 1897. By THOMAS S. DYMOND and FRANK HUGHES (*Chem. News*, 1899, 80, 191—194).—A large area of land was rendered infertile by flooding with sea-water, which itself contained 2·7 per cent. of sodium chloride, or sufficient to cause plasmolysis; the soil which had been flooded contained, however, an amount of salt insufficient to produce that effect. The quantity varied with the character of the soil and period of flooding, but on an average amounted to 0·25 per cent. in the top soil, or 25 times more than the average amount in the soil from land not flooded; nevertheless, pot cultures showed that many plants could grow in the soil from the flooded land. Investigation showed that the infertility was due to the extermination of the earth-worm and to the clay having become more gelatinous, and the soil consequently rendered less pervious to water. This condition was attributable to an increase in the combined water of the clay which was accompanied by a reduction by $\frac{1}{4}$ th in the amount of lime, magnesia, potash, and soda. Although the total potash in the clay had been reduced from 1·12 to 0·84 per cent., the available potash had increased from 0·025 to 0·079 per cent.; the available phosphates had also increased in quantity. To restore the land, good cultivation, good draining to aid the washing out of the salt, manuring with lime, with nitrogenous manures, with long hay manure, and if phosphate is required, with basic slag, are recommended. Suitable plants for crops are mentioned.

D. A. L.

Field Experiments with Superphosphate and Basic Slag. By PAUL BAESSLER (*Bied. Centr.*, 1900, 29, 12—13; from *Ber. Agrik.-Chem. Versuchs-Stat. Köslin* for 1897, 113).—Barley and oats were manured with equal amounts of water and citrate-soluble phosphoric acid (as superphosphate and basic slag), in addition to kainite and nitrate. The soil was a humous, loamy, or slightly loamy, sandy soil containing 0·064—0·091 per cent. of phosphoric acid, of which 4 or 5 parts dissolved in 1 per cent. citric acid.

Owing to unfavourable weather, the results were very irregular. Taking all the results together, it is seen that 40 kilos. of phosphoric acid soluble in water increased the yield of grain by 223, and the yield of straw by 147, kilos. per hectare, whilst the same amount of phosphoric acid soluble in citric acid increased the yields by 183 and 278 kilos. respectively. With 60 kilos. of phosphoric acid per hectare, the increase of grain was 310 kilos. with water soluble, and 288 with citrate soluble phosphate, and the increase of straw 412 and 435 kilos.

The results do not confirm the opinion that basic slag must be applied in the autumn.

N. H. J. M.

Field Experiments with Potash-lime Manure and Fish Guano. By PAUL BAESSLER (*Bied. Centr.*, 1900, 29, 10—12; from *Ber. Agrik.-Chem. Versuchs-Stat. Köslin* for 1897, 120).—Experiments were made in which winter-rye and sugar-beet were grown in humous, sandy soil, manured with the same amounts of potash in the form of potash-lime manure* and kainite, in addition to superphosphate. There were also plots manured with superphosphate alone, and with fish guano. The effect of the two potash manures on rye was only slight, and was almost the same. The results of the superphosphate and fish guano showed that the effect of the latter depended mainly on the nitrogen it contained. In the case of sugar-beet, the potash manures had a decided effect on the leaf development and on the yield of roots, but the effect of the two manures was nearly the same.

The results of experiments on meadows, as well as those just described, showed that potash-lime manure is mainly of use as a potash manure.

N. H. J. M.

Importance of Poultry Manure. By R. ULRICH (*Bied. Centr.*, 1900, 29, 3; from *Fühling's Landw. Zeit.*, 1897, 627).—Pigeons, fowls, ducks, and geese produce yearly 2·5, 5·5, 8·5, and 11 kilos. of manure per head. The composition of the manure is as follows:

	Water.	Organic matter.	N.	P ₂ O ₅ .	Alkali salts.	Ash.
Pigeons	62	31—32	1·2—2·4	3·0—4·2	2·0—2·2	6—7
Fowls...	65	21—26	0·7—1·9	5·0	1·2—1·6	9—14
Ducks..	53	40	0·8	3·5	0·4	7
Geese...	82	14	0·6	0·9	3·1	4

The nutritive constituents are in a readily soluble and concentrated form, especially in the case of pigeon-dung, and must be employed with care. The manures should not be employed in dry weather, or on soil which is dried up; they should be mixed with water, and addition of sulphuric acid (30 lb. per cwt.) is recommended. They may be applied to roots and cabbages, &c., with advantage.

N. H. J. M.

Analytical Chemistry.

Perezone, a New Indicator for Alkalimetry. By MAURICE DUYK (*Chem. Centr.*, 1900, i, 60; from *Ann. chim. anal. appl.*, 1899, 4, 372).—Perezone (pipitzaholic acid), which exists to the extent of about 5 per cent. in the rhizomes of *Perezia adnata*, is an extremely sensitive alkalimetric indicator (compare Abstr., 1885, 805). A drop of a 5 per cent. alcoholic solution gives a feeble opalescence to

* This is a waste product from the manufacture of potash, and contains CaCO₃, 41·8; K₂SO₄, 7·7; CaO, 0·33; K₂O (as sulphate), 4·2 per cent., besides water (about 25 per cent.), Fe₂O₃, Al₂O₃, MgCl₂, NaCl, and SiO₂ (*Bied. Centr.*, 1898, 27, 306).

distilled water, and the liquid becomes rose-coloured with traces of alkalis. Ammonia, aniline, pyridine, and alkaloids, carbonates, hydrogen carbonates, borates, and acetates behave as alkalis. The red liquid becomes colourless on adding mineral or organic acids, or carbon dioxide. Boric acid has an alkaline reaction, but after adding glycerol behaves as an acid. M. J. S.

Retention of Moisture by Asbestos. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1900, 22, 46—47).—Some kinds of asbestos retain moisture with great tenacity, even after drying at 100°; on heating again over a blast, a loss of several milligrams may occur. It is therefore advisable to ascertain once for all the amount of water retained in a sample which is intended for use in a Gooch crucible. L. DE K.

Estimation of Water in Syrups and similar Products. By OSKAR MOLENDÁ (*Chem. Centr.*, 1900, i, 71—72; from *Oesterr.-ung. Zeit. Zucker-Ind. und Landw.*, 28, 621).—The author makes use of the reaction between water and calcium carbide, and measures the acetylene evolved. Scheibler's calcimeter is convenient for the purpose. Solutions stronger than 30 per cent. cannot be employed; those of 20—27 saccharimetric degrees are the most suitable. The syrup must therefore be diluted with water, and the amount of water added is best estimated from polarimetric observations of the original substance and the dilute solution. About 0.1 gram of the dilute solution is taken, and the formula $0.612 A/\text{subs.}$ in grams, in which A represents the percentage of calcium carbonate given by the calcimeter table as corresponding with the volume of gas, gives the percentage of water. Pure water gave an average result of 98.83 per cent., and sugar solutions of known composition gave differences averaging 2.56 per cent. M. J. S.

Estimation of Sulphur in Ores, Mattes, &c. By P. TRUCHOT (*Chem. Centr.*, 1900, i, 62; from *Ann. chim. anal. appl.*, 4, 374).—A gram of the finely powdered substance is rapidly heated in a covered beaker with 25 c.c. of concentrated nitric acid so long as red fumes are evolved. The liquid is cooled, twice warmed gently for 5 minutes with 1 c.c. of bromine, then evaporated on the water-bath almost to dryness, boiled with 15 c.c. of hydrochloric acid, diluted with 250 c.c. of water, filtered, and precipitated while boiling with barium chloride. M. J. S.

Estimation of Sulphur in Pig Iron and Cast Iron. By ADOLF RIEMER (*Chem. Centr.*, 1900, i, 61—62; from *Stahl. und. Eisen*, 1899, 19, 1064).—Wiborgh's method (*Abstr.*, 1886, 743) is utterly untrustworthy, indicating only about half the sulphur present. A rapid and exact method is to dissolve the metal in concentrated hydrochloric acid, and pass the evolved gases (after first washing with water) through ammoniacal cadmium acetate. An excess of standard iodine solution is added, the mixture acidified with hydrochloric acid, and the excess of iodine then titrated with thiosulphate. In very exact analyses, the cadmium sulphide precipitate should be collected and washed. M. J. S.

Estimation of Sulphur in Pyrites. By OLE N. HEIDENREICH (*Chem. Zeit.*, 1900, 24, 15).—The author recently improved the estimation of sulphur in pyrites or burnt pyrites by reducing the ferric solution to the ferrous state by means of zinc before adding barium chloride (Abstr., 1899, ii, 517). Thiel has stated that the supposed accuracy of the results is only due to a fortunate compensation of errors (this vol., ii, 242). In reply, the author points out that Meineke has independently investigated the method and finds the results to be trustworthy (Abstr., 1899, ii, 518, 693).

L. DE K.

Estimation of Sulphur in Bitumens. By A. C. LANGMUIR (*J. Amer. Chem. Soc.*, 1900, 22, 99—102).—The author criticises the process recommended by S. F. and H. E. Peckham (this vol., ii, 44), and points out several sources of error. No precautions are taken to prevent absorption of sulphur compounds during the fusion with alkali nitrate and the subsequent slow evaporation of the dissolved mass with hydrochloric acid. The most serious objection is, that on precipitating the iron and aluminium by means of ammonia and expelling the excess of the latter by boiling, a portion of the sulphuric acid recombines with the iron. Finally, if the sulphuric acid is precipitated after removing the calcium with ammonium oxalate, there is a danger of obtaining a very impure barium sulphate, which is rendered still more probable by the presence of a large quantity of alkali chlorides.

Eschka's process, as described by Heath, is admittedly the best process for the estimation of sulphur in bituminous coals.

L. DE K.

Estimation of Alkali Persulphates and of Hydrogen Peroxide. By BRUNO GRÜTZNER (*Arch. Pharm.*, 1899, 237, 705—706).—About 0.3 gram of the *persulphate* is heated to boiling with 50 c.c. *N*/10 arsenious acid, and a few grams of aqueous potassium or sodium hydroxide, the whole digested for a little while, cooled, made faintly acid with sulphuric acid, treated with a large excess of sodium hydrogen carbonate, mixed with starch solution, and titrated with *N*/10 iodine solution. 1 c.c. *N*/10 $\text{As}_2\text{O}_3 = 0.0135$ gram $\text{K}_2(\text{SO}_4)_2$, 0.0119 $\text{Na}_2(\text{SO}_4)_2$, or 0.0114 $(\text{NH}_4)_2(\text{SO}_4)_2$. The error in the analyses quoted does not exceed ± 0.2 per cent.

Of a commercial sample of *hydrogen peroxide*, 10 c.c. are diluted to 100 c.c., and 10 c.c. of the dilute solution treated as is the persulphate in the method just described; 1 c.c. *N*/10 $\text{As}_2\text{O}_3 = 0.0017$ gram of hydrogen peroxide. A result was obtained 0.04 per cent. higher than by titration with permanganate. Sodium peroxide cannot be analysed in this way.

C. F. B.

Estimation of Ammonia and of Nitrogen. By ANTOINE VILLIERS and E. DUMESNIL (*Compt. rend.*, 1900, 130, 573—576).—The estimation of ammonia by titration is often inaccurate, because of the effect of ammonium salts on the indicator used, and better results are obtained by weighing the ammonia in the form of ammonium chloride. The ammonia is absorbed in an excess of dilute hydro-

chloric acid which has previously been found to leave no residue on evaporation, and the solution is concentrated in a porcelain dish over a small flame which heats only the bottom and not the sides of the vessel. When the liquid is reduced in volume to about 25 c.c., it is transferred to a small weighed conical flask, in which the evaporation is completed, the residue being dried at 105°. C. H. B.

The Phosphometer, an Apparatus for the Clinical Estimation of Phosphorus in Blood. By ADOLF JOLLES (*Chem. Centr.*, 1900, i, 486—487; from *Wien. Med. Woch.*, 1899, Nos. 46, 47).—The estimation is a colorimetric one, in which the yellow coloration produced by potassium molybdate in solutions of phosphates is used as a measure of the phosphate present. The intensity of the colour varies with the temperature, reaching its maximum at 80°. The comparison tubes are therefore observed in a cylindrical vessel surrounded by a water jacket, and are so arranged that three tubes (one of which contains the substance and the other two standards) can be simultaneously seen by light thrown upward from an oblique mirror below the cylinder. The substance is prepared by evaporating a measured quantity of the blood (0.1 c.c.) in a platinum crucible, fusing the residue with a mixture of sodium carbonate and potassium nitrate (3:1), and dissolving the fused mass in dilute nitric acid. The comparison solutions are prepared by dissolving 18.7324 grams of sodium pyrophosphate in 50 c.c. of nitric acid of sp. gr. 1.2 and diluting to a litre; from this solution, others are prepared containing 2, 0.2, and 0.02 milligrams of P_2O_5 per c.c. The potassium molybdate solution contains 8 grams of the salt in 50 c.c. of water and 50 c.c. of nitric acid of sp. gr. 1.2; for use, 1 c.c. of this solution is diluted to 20 c.c. M. J. S.

Simplified Method of Estimating Phosphoric Acid by Molybdate. By JOSEPH HANAMANN (*Chem. Centr.*, 1900, i, 488—489; from *Zeit. landw. Vers.-Wes. Oesterr.*, 3, 53).—By employing a molybdate solution containing more nitrates than the usual one, and precipitating at 40°, the precipitation of the phosphoric acid is complete in ten minutes, and the precipitate is of constant composition after gentle ignition, containing 3.94495 per cent. of phosphoric oxide. The molybdate solution is made by dissolving 100 grams each of ammonium molybdate and ammonium nitrate in 150 c.c. of ammonia of sp. gr. 0.91 and pouring the solution into a litre of nitric acid of sp. gr. 1.2. After boiling the solution, it is filtered into bottles of brown glass, and kept in a cool place. M. J. S.

Wagner's New Reagent for Estimating Soluble Phosphoric Acid in Basic Slag. By ADOLFO CASALI (*Chem. Centr.*, 1900, i, 62; from *Staz. sper. agrar. ital.*, 32, 486).—The use of citric acid for extracting the soluble phosphate from basic slag gives a much higher result than that obtained with the ammonium citrate more usually employed. In reporting the results of analyses, it should always be stated which reagent has been used. M. J. S.

Detection of Adulterations in Bone Superphosphate. By HENRI LASNE (*Chem. Centr.*, 1900, i, 72—73; from *Ann. chim. anal. appl.*, 4, 361).—The results of the estimations made should be

expressed in the form of ratios to 100 parts of phosphoric oxide present. The total phosphoric oxide and calcium oxide are first estimated. In normal bone, this ratio is 100:129—134. A higher ratio of calcium oxide points to the addition of either gypsum or mineral phosphate. Gypsum is sought for by the microscope. A deficiency of calcium oxide indicates addition of precipitated phosphate. Calcium chloride is also estimated. A ratio of 0.15 is compatible with purity; 0.3 points to the addition of gypsum, and a higher ratio is characteristic of precipitated phosphate. Addition of mineral phosphate raises the ratio of aluminium and insoluble matter (containing titanium) and also that of calcium fluoride (of which only traces are normally present), or, in the case of certain phosphates which are poor in fluorine, introduces manganese. Bone ash is best detected by partially precipitating with ammonia, collecting the precipitate, and treating it with dilute hydrochloric acid, when fragments of bone can be seen. The part of a normal bone-superphosphate insoluble in dilute hydrochloric acid seldom contains more than 0.1 of nitrogen per 100 parts of original substance; a greater proportion indicates addition of nitrogenous waste materials. The superphosphate itself should contain about 0.6 per cent. of nitrogen (see also this vol., ii, 167).

M. J. S.

Separation and Estimation of Arsenic and Antimony in Ores. By O. C. BECK and H. FISHER (*Chem. News*, 1899, 80, 259—261).—A critical examination and comparison of various known methods. The best results for arsenic were obtained by Pattinson's method (Abstr., 1899, ii, 56) of titrating the sulphide with iodine; weighing the sulphide gave results which were too high. Fischer's distillation method (Abstr., 1881, 195) gave good results, but, like Pearce's nitrate method (*Chem. News*, 1883, 48, 85), took too long; the latter, moreover, even when modified, gave low results. For antimony, Weller's method (Abstr., 1882, 1324) and Mohr's method gave fairly concordant results, whilst weighing the antimony as sulphide gave results too high, and as oxide, too low. Jannasch's modification occupied more time and introduced much sulphur, but gave higher results.

D. A. L.

Volumetric Estimation of Boric Acid. By ALFRED STOCK (*Compt. rend.*, 1900, 130, 516—517. Compare this vol., ii, 47).—In estimating boric acid by Jones's volumetric method (Abstr., 1899, ii, 322), it is essential that carbon dioxide should be absent; traces of this gas are most conveniently removed by boiling the solutions employed before titration; the removal of the gas by means of barium chloride is not to be recommended, because the barium carbonate produced interferes with the end point. The presence of salts of the alkali and alkaline earth metals does not affect the process; when iron and aluminium are present, their insoluble hydroxides are produced; the titration must, however, be performed in the presence of these substances, since the precipitate may contain variable quantities of borates; these salts are readily decomposed by the standard sodium hydroxide, and accurate results are obtained even under these conditions.

G. T. M.

The Accuracy of Jörgensen's Method for Estimating Boric Acid in Preserved Meat, and the Separation of Boric Acid from Borax. By ADOLF BETTHIEN and HANS HEMPEL (*Chem. Centr.*, 1900, i, 63—64; from *Zeit. Unters. Nahr.-Genussmitt.*, 2, 842).—Jörgensen's method depends on the fact that a boric acid solution, rendered neutral to phenolphthalein by addition of alkali, becomes acid again on adding a sufficient quantity of glycerol, so that the boric acid can be titrated by an alkali which has been standardised by a boric acid solution of known value, under similar conditions as regards amount and concentration. The results are very satisfactory.

To estimate the boric acid in meat, the substance may either be extracted by warming for several hours with strong sodium hydroxide solution, and the extract evaporated and incinerated, or, more expeditiously and with little loss of accuracy, by direct incineration of the meat itself after carefully and thoroughly saturating it with a large excess of an alkaline solution. The ash, in either case, is dissolved in 50 c.c. of dilute sulphuric acid, the solution warmed gently, which can be done without noteworthy loss, cooled, and made exactly neutral to phenolphthalein: 25 c.c. of glycerol are then added and the titration made. Addition of alcohol renders the end sharper. With mixtures of 100 grams of flesh, and 0.1 gram of boric acid, the results varied from about -5.4 to +1.67 per cent. of the boric acid used.

It has been stated that in cooking salt meat containing boric acid, the greater part of that substance is lost. American salt meat containing 1.12 and 1.17 per cent. of boric acid lost only 0.41 per cent. by soaking and washing, and 0.59—0.67 by boiling; the broth contained 0.60—0.57 part per 100 parts of the original meat. The broth ought therefore never to be consumed.

The authors are experimenting on the use of acetone for separating boric acid and borax. M. J. S.

Estimation of Silicon in Ferro-chromium and of Silica in Chrome Ore. By GEORGE TATE (*Chem. News*, 1899, 80, 235).—Ferro-chromium or chrome ore (1—2 grams) is fused with about five times its weight of sodium peroxide in a nickel crucible, and when cold immersed in water in a nickel dish, neutralised with hydrochloric acid, and evaporated to dryness. The residue is heated with 40 c.c. of strong sulphuric acid until fumes of sulphuric acid appear. When cool, it is treated cautiously with water, transferred to a porcelain dish, made up to about a $\frac{1}{4}$ -litre, boiled to dissolve the sulphates, and the residual silica is washed, dried, ignited, and weighed; if coloured, it is evaporated with hydrofluoric acid and a drop of sulphuric acid, and any residue weighed and deducted. D. A. L.

Estimation of Graphite by Loss. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1900, 22, 47—48).—Asbestos is preferable to filter paper for collecting the graphite left on dissolving iron, but attention is called to the retention of water by asbestos (this vol., ii, 309).

The process is not altogether free from sources of error, but these do not appreciably affect the result when the percentage of graphite

is small. The graphite is not always pure carbon, but may contain small quantities of hydrogen, oxygen, nitrogen, and sulphur.

L. DE K.

Iodometric Estimation of Small Quantities of Carbon Monoxide. By LEONARD P. KINNICUT and GEORGE R. SANFORD (*J. Amer. Chem. Soc.*, 1900, 22, 14—18).—The process has been devised for the estimation of small quantities of carbon monoxide in air contaminated by leakage of water-gas, &c. 1000 c.c. of air are drawn through two U-tubes respectively containing sulphuric acid and potassium hydroxide, to absorb unsaturated hydrocarbons, hydrogen sulphide, sulphur dioxide, and similar reducing gases; it then passes through another U-tube containing 25 grams of pure iodine pentoxide, and suspended in an oil-bath heated at 150°. The action of carbon monoxide on the hot iodine pentoxide causes liberation and volatilisation of free iodine, which is collected in a Wolff's blood-absorption-tube containing 0.5 gram of potassium iodide dissolved in 5 c.c. of water. The iodine is then titrated with *N*/1000 sodium thiosulphate.

One milligram of iodine represents 0.4357 c.c. of carbon monoxide.

L. DE K.

Rapid Method of Estimating Carbon Dioxide in Gaseous Mixtures. By LÉO VIGNON and LOUIS MEUNIER (*Compt. rend.*, 1900, 130, 513—515).—A large, cylindrical glass vessel of known capacity is connected with a burette and an inlet tube for the introduction of a gaseous mixture. When the apparatus is filled with the gas, about 40 c.c. of alcohol (93 per cent.), containing a small quantity of phenolphthalein, are run in, and the mixture is titrated with *N*/20 calcium hydroxide solution. The method is applicable to the estimation of carbon dioxide in any mixture of neutral gases; when ammonia and hydrogen sulphide are present, these are removed by passing the gas through an acetic acid solution of lead acetate before collecting it in the titrating cylinder.

G. T. M.

Volumetric Estimation of Magnesia. By JAMES O. HANDY (*J. Amer. Chem. Soc.*, 1900, 22, 31—39).—This is a modification of Stolba's process (1866), which has not found much favour.

The magnesia solution, freed from calcium, aluminium, &c., is precipitated as usual with solution of sodium ammonium hydrogen phosphate, and the precipitate carefully washed with dilute ammonia (1:9). When drained, the filter is opened flat and placed on thick, dry filter paper for a few minutes, then transferred to a second dry paper, and left for 30 to 60 minutes, after the moisture has been practically absorbed. The small amount of ammonia still adhering to the precipitate is then expelled by heating for 20 minutes in an air-bath at 50—60°.

The filter with the precipitate is now put into a small beaker, and an excess of *N*/10 sulphuric acid is added. When the precipitate has dissolved and the paper been disintegrated by stirring, two drops of a 0.1 per cent. alcoholic solution of methyl-orange are added, and the excess of acid titrated with *N*/10 sodium hydroxide. 1 c.c. of *N*/10 sulphuric acid = 0.002 gram of magnesia.

L. DE K.

Estimation of Copper. By M. WILLENZ (*Chem. Centr.*, 1900, i, 490; from *Ann. chim. anal. appl.*, 5, 2).—The method of precipitation by sodium thiosulphate is strongly recommended. The substance is dissolved in nitric acid, the solution evaporated with sulphuric acid, and precipitated boiling with 5–6 grams of thiosulphate for each gram of substance. Cadmium and lead are not precipitated, neither are arsenic and antimony if the solution is strongly acid and hot; they separate, however, on cooling and diluting. Traces of both are therefore contained in the copper precipitate, but can be driven off by intense ignition.

M. J. S.

Precipitation and Separation of Copper in the Presence of Sodium Hydroxide by the Aid of Hydrazine Sulphate or Hydrochloride. By PAUL JANNASCH and K. BIEDERMANN (*Ber.*, 1900, 33, 631–636).—When a 3 per cent. solution of hydrazine sulphate is added to a copper sulphate solution in the presence of an excess of pure sodium hydroxide and the whole warmed on a sand-bath, the copper is deposited in the metallic state and may be filtered by the aid of a double paper, well washed, dried at 90°, and weighed as cupric oxide after ignition, if necessary, in a current of oxygen.

Copper may be readily separated from zinc or arsenic by this method, as in strongly alkaline liquids only the copper salt is reduced; the zinc may then be precipitated as carbonate and the arsenic as magnesium ammonium arsenate. In the separation of tin and copper, the alloy (1 part) is dissolved in as small a quantity of aqua regia as possible; the solution thus obtained is diluted with its own volume of water and is slowly added to a solution of pure sodium hydroxide (15 parts) and hydrazine hydrochloride (2–3 parts); when the sulphate is employed, small amounts of tin are always carried down with the copper. After the mixture has been warmed for some time, the copper is removed and treated as before; the alkaline filtrate is acidified with hydrochloric acid, precipitated with ammonia, the precipitate dissolved in ammonium sulphide, and reprecipitated as sulphide of arsenic by the careful addition of hydrochloric acid.

J. J. S.

Rapid Estimation of the Purity of Commercial Copper Sulphate, and of the Amount of Copper Sulphate in Copper Pyrites. By CARLO MONTANARI (*Chem. Centr.*, 1900, i, 66; from *Staz. sper. agrar. ital.*, 32, 479).—Zecchini's method (*Staz. sper. agrar. ital.*, 32, 117) gives rapid and exact results, especially if a $N/20$ solution be employed instead of that recommended by Zecchini. Scarlata's method (*Mon. Sci.*, [iv], 13, i, 409) is troublesome and inexact.

M. J. S.

Estimation of Aluminium. By ALFRED STOCK (*Ber.*, 1900, 33, 548–553).—The greater part of this paper has already been published (this vol., ii, 247). Aluminium hydroxide, obtained by adding a mixture of potassium iodide and iodate to a faintly acid solution of an aluminium salt, and removing the liberated iodine by sodium thiosulphate (*loc. cit.*), has, after drying in the air, the composition $Al(OH)_3$; after drying over calcium chloride, the composition $2Al_2O_3 \cdot 5H_2O$, and after drying at

130°, $3\text{Al}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$; this last hydrate, when exposed to the air, absorbs water until its composition is again represented by the formula $\text{Al}(\text{OH})_3$. The individuality of the various hydrates is being investigated.

In presence of a large excess of sulphates, the precipitated hydroxide contains sulphuric acid, which is, however, lost on ignition. This circumstance interferes with the alkalimetric titration of alum solutions, but the error may easily be avoided by adding a slight excess of barium chloride to the solution, and then titrating as usual without filtering.

A. H.

Rapid Method for the Estimation of Clay in Soils. By F. POQUILLON (*Bull. Soc. Chim.*, 1900, [iii], 23, 115—116).—In the process described, the mechanical separation of the sand and clay is facilitated by the use of a dilute solution of ammonium chloride instead of pure water, and the number of washings and bulk of liquid employed is diminished. 10 grams of the soil are rubbed up with 25 c.c. of water, and the liquid mixed with 100—120 c.c. of a 0.1 per cent. solution of ammonium chloride and left for 5 minutes. The supernatant liquid is then decanted, and the operation repeated 6—8 times until the washings are clear, when the residual sand is washed, first with dilute hydrochloric acid and then with water, dried, and weighed. The turbid washings are mixed, acidified with hydrochloric acid, left for 2—3 hours, and the precipitated clay is collected on a filter, washed with water, dried, and weighed.

N. L.

Estimation of Nickel in Nickel Ores. By A. C. LANGMUIR (*J. Amer. Chem. Soc.*, 1900, 22, 102—106).—This is a slight modification of Sargent's process (this vol., ii, 51), and may be applied to ores. The method is briefly as follows: the ore is oxidised with nitric acid and bromine, mixed with excess of hydrochloric acid, and boiled down to a small bulk. After diluting with water, copper, &c., are removed by means of hydrogen sulphide. The filtrate is boiled, and the ferrous iron oxidised by cautious addition of nitric acid. Slight excess of ammonia is added, and the filtrate which contains the bulk of the nickel is evaporated in a large casserole. The precipitate is dissolved in hydrochloric acid, boiled down to a pasty mass, dissolved in hydrochloric acid of sp. gr. 1.1, and then agitated with two separate portions of ether. This dissolves the ferric chloride, leaving the nickel in the acid layer. Any iron still remaining is precipitated with bromine and ammonia, and freed from the last traces of nickel by redissolving and precipitating a second time. The ammoniacal solution containing the nickel is now also introduced into the casserole, and the whole evaporated until ammonium chloride begins to separate; this is destroyed by adding a large excess of nitric acid and evaporating to dryness. The nitrate is now converted into sulphate by heating with strong sulphuric acid, the liquid diluted, mixed with excess of ammonia, and submitted to electrolysis.

L. DE K.

Rapid Evaluation of Metallic Tungsten Powders. By FRED IBBOTSON and HARRY BREARLEY (*Chem. News*, 1899, 80, 294—295).—Three grams of the powder are ignited in a tared platinum dish until

completely oxidized, re-weighed, treated with hydrofluoric acid to remove silica, and again weighed. It is boiled with pure caustic soda to dissolve as much tungsten as possible, and the residue, which contains iron, manganese, and some tungsten, is collected, washed, ignited, and weighed; it is then dissolved in a small quantity of hydrochloric acid, and should leave no residue if properly ignited at the commencement. The solution is largely diluted to precipitate the tungsten, which is collected and weighed, whilst the iron and manganese may be estimated in the filtrate. The tungsten in the caustic soda solution may also be determined. In this way, with the pure materials used in steel manufacture, useful numbers may be obtained for the silica, tungsten, iron, and manganese. The proportion of tungstic oxide may be ascertained by treating the unheated sample with a large volume of strong hydrochloric acid, which dissolves the oxide, but not the metal. Carbon may be determined by simply heating in a current of oxygen. Sulphur is not usual in samples for steel making, but if present would interfere with the scheme of analysis set forth, and so must be removed beforehand.

D. A. L.

Analysis of Tungsten Compounds. By FRED IBBOTSON and HARRY BREARLEY (*Chem. News*, 1899, 80, 293—294).—On adding strong nitric acid, drop by drop, to a boiling solution of lead tungstate, a change of colour from white to yellow ultimately takes place, boiling for a short time with a few additional c.c. of the acid then develops the full yellow colour of tungstic oxide; the change is quantitative, and may be applied to the estimation of tungsten, making a correction for the small amount of tungstic acid that passes away in the filtrates. Ammonia, if present, is not eliminated; barium, strontium, calcium, magnesium, zinc, cadmium, manganese, nickel, and cobalt do not interfere with the reaction, but arsenic, mercury, uranium, iron, tin, and silicon do, although the interference of arsenic and mercury may be disregarded. In the presence of uranium salts, the solution containing a small excess of sodium carbonate is heated to boiling, and is poured in a thin stream into hot acetic acid containing excess of lead acetate, with vigorous shaking. The mixture is just boiled, the precipitate washed by decantation, &c. The tungstic oxide finally obtained is free from uranium. Iron and aluminium in small quantities may be dealt with by making the solution just alkaline, then faintly acid with acetic acid; most of the tungsten is precipitated with the iron, and the rest is precipitated by lead acetate. The precipitate is washed by decantation, ignited, and treated with hydrochloric acid as though it were pure lead tungstate. Chromium cannot be treated in this manner, and the interference of tin and silicon cannot be avoided. In the last instance, however, the whole of the tungsten may be precipitated from a neutral solution as mercurous silicotungstate by means of mercurous nitrate, the silica in the ignited residue being removed by hydrofluoric acid. Ammonia and ammonium carbonate effect the separation of silica and tungstic oxide imperfectly.

D. A. L.

Ammonium Molybdate as a Delicate Reagent for Stannous Chloride. By J. P. LONGSTAFF (*Chem. News*, 1899, 80, 282—283).—Tin may be detected in solution, in quantities that might escape detection by the ordinary qualitative tests, by means of the blue coloration produced by ammonium molybdate with stannous chloride. The solution, to be tested, must be freshly prepared, and diluted with boiled water to avoid oxidation as much as possible; moreover, it must not contain strong hydrochloric acid, as this destroys the colour. One part of tin, as stannous chloride, in 1,500,000 of solution has been detected by this means. D. A. L.

Significance of the Detection of Nitrites in Drinking Water. By LEOPOLD SPIEGEL (*Ber.*, 1900, 33, 639—644).—The author criticises Erdmann's proposition (this vol., ii, 243) to employ 1-amino-8-naphthol 4:6-disulphonic acid along with sulphanilic acid as a test for nitrites in drinking water. Erdmann's statements that nitrous acid is present in all water containing a small quantity of animal matter, and that every good drinking water is free from nitrous acid, are shown to be erroneous. The author is of opinion that the presence of nitrites in water is no criterion of its value for drinking purposes, as this can only be deduced from a complete examination of the water, coupled with the knowledge of the nature of the soil in which it occurs.

In place of Erdmann's reagent for nitrous acid, the author proposes to use either of the less sensitive compounds, guaiacol and creosote, which, in dilute aqueous solution, give with nitrous acid an orange and a yellow coloration respectively. These reactions are not interfered with by the presence of oxidising agents, such as nitrates, chlorates, and hydrogen peroxide, or by ferric salts in such concentrations as are met with in potable waters. T. H. P.

Cobalticyanides. By EDMUND H. MILLER and JOHN A. MATHEWS (*J. Amer. Chem. Soc.*, 1900, 22, 62—69).—The authors give instructions for the preparation of the metallic cobalticyanides, and their chief properties are described in an accompanying table.

Potassium cobalticyanide may perhaps be used in quantitative analysis. As the lead salt is very soluble, whilst those of silver, copper, and bismuth are insoluble in water or nitric acid, it may perhaps be useful in the assay of pig lead. The bismuth may then be separated from the copper by treatment with hydrobromic acid, which dissolves the bismuth cobalticyanide and leaves the copper, together with any silver compound, undissolved; or by treating the precipitate with ammonia in which the copper and silver compounds dissolve, leaving the bismuth. The bismuth may be separated from the compound as hydroxide by digesting it with aqueous potassium hydroxide.

It also affords a means of separating zinc, manganese, nickel, or cobalt from ferric iron, as the latter is not precipitated in the presence of sufficient ammonium sulphate. The zinc compound may be separated from the others by dissolving it in aqueous potassium hydroxide, which leaves the manganese, cobalt, and nickel in the form of hydroxides. Further results are promised. L. DE K.

Chemistry and Analysis of Wines. By MAXIMILIAN RIPPER (*Chem. Centr.*, 1900, i, 436—437; *Zeit. Landw. Vers.-Wesens. Oesterr.*, 3, 26).—In continuation of previous work on this subject (*Abstr.*, 1899, ii, 699), attention is directed to the aldehydes and their compounds contained in wine. Aldehydes or ketones may be detected in all wines by distilling 200 c.c. of the wine, and testing the first 20 c.c. of the distillate with phenylhydrazine hydrochloride, Guyon's reagent, *m*-phenylenediamine hydrochloride, ammoniacal silver solution, or resorcinol and hydrochloric acid. For estimation, 50 c.c. of the wine are mixed with 5 c.c. of sulphuric acid (1 : 3) and some starch, and titrated with *N*/50 iodine solution. To another 50 c.c. in a flask 50 c.c. of *N*/50 potassium hydrogen sulphite are added, and the corked flask is kept for $\frac{1}{4}$ hour, at the end of which time 5 c.c. of sulphuric acid are added and the mixture is titrated with the iodine solution. The iodine value of the sulphite solution is also estimated. The amount of iodine required by the wine alone is subtracted from that consumed by the mixture of wine and sulphite, and this difference is subtracted from the amount of iodine required by the sulphite alone. The difference is calculated into acetaldehyde. M. J. S.

Estimation of Cresols by Determining their Capability of forming Bromo-substitution Derivatives. By ROBERT CLAUSER (*Chem. Centr.*, 1900, i, 118; from *Oesterr. Chem.-Zeit.*, 2, 585—588).—*o*-Cresol may be estimated by Koppeschaar's method, with a maximum error of +0.5 per cent. The solution should contain only 1/30,000—1/40,000th of its weight and the quantity of the bromide-bromate solution added should be sufficient to supply 6 atoms of bromine for each mol. of cresol present. As soon as the yellow coloration appears, the action requires to be checked by adding potassium iodide and allowing the mixture to remain for half an hour.

E. W. W.

Estimation of the Reducing Power of Urine, Blood, and other Animal Fluids. By HEINRICH ROSIN (*Chem. Centr.*, 1900, i, 48; from *Münch. med. Woch.*, 46, 1456).—The author formerly proposed to effect this object by ascertaining the amount of methylene-blue decolorised by a given volume of the urine under certain conditions. A more satisfactory method is to use the methylene-blue merely as an indicator, and to employ potassium permanganate as the oxidising agent. The urine is diluted five-fold; 25 c.c. are placed in a small Erlenmeyer flask, mixed with 1 c.c. of officinal potassium hydroxide solution, covered with paraffin oil to exclude air, and heated, but not to boiling. From a burette, the point of which dips below the paraffin layer, 1 c.c. of methylene-blue solution (1 : 3000) is then introduced, and then in a similar manner *N*/100 permanganate, until a bluish-green colour is obtained. The permanganate required is a measure of the reducing power of the urine. M. J. S.

Detection of Sucrose in Margarine. By MECKE (*Chem. Centr.*, 1900, i, 435; from *Zeit. öffent. Chem.*, 5, 496).—To communicate to margarine the properties of natural butter, sucrose and yoke of egg are added to it. Sucrose can be estimated in presence of lactose by the polarimeter, but the difficulty of obtaining clear solutions from

margarine renders this method inadmissible. The sugars are therefore estimated gravimetrically before and after inversion with citric acid.

M. J. S.

Analysis of Golden Syrup. By RICHARD BODMER, NORMAN LEONARD, and HARRY M. SMITH (*Analyst*, 1899, 24, 253—257).—Attention is called to the growing practice of adulterating golden syrup with glucose, the product of the hydrolysis of starch.

The adulteration may be detected and even approximately estimated by taking the copper-reducing power of the sample (calculated on the dry substance) before and after inversion; another inversion experiment is made in which not only the sucrose but any dextrin or maltose is also inverted. The copper-reducing power, coupled with a polarimetric test, is sufficient to enable an opinion to be formed on the sample. In the equation given to facilitate the calculation, it is assumed that commercial starch-glucose has a copper-reducing power of 53 and a specific rotation of $+134^\circ$ for sodium light. The analyses of several commercial samples of golden syrup are given in a table (compare following abstract).

L. DE K.

Analysis of some Sugar Syrups. By ALEXANDER K. MILLER and J. P. POTTS (*J. Soc. Chem. Ind.*, 1899, 18, 1091—1093).—The authors criticise the process recently introduced by Bodmer, Leonard, and Smith (preceding abstract).

Owing to the uncertain nature of commercial glucose, analyses made by means of the polariscope are untrustworthy quantitatively, although they have a qualitative value. For such a qualitative test, the following procedure is recommended:—Determine the polarimetric reading of a 10 per cent. solution (or other suitable strength) of the syrup; invert the cane-sugar in a portion of the solution and again determine the rotation. From the difference between the two readings, the cane-sugar can be determined, and from this the rotation due to the cane-sugar calculated. If this is deducted from the original rotation, the difference will represent the rotation due to the dextrose and lævulose, if the sugar is a genuine sugar syrup, and the result will generally be a lævo-rotation. The process should be supplemented by a fermentation experiment; further investigation seems very desirable.

L. DE K.

Effect of the Presence of Glycuronic Acid on the Phenylhydrazine Test for Sugar in Urine. By PAUL MAYER (*Chem. Centr.*, 1900, i, 284—285; from *Berlin klin. Woch.*, 37, 5—7. Compare this vol., ii, 155).—When ordinary urine is treated with phenylhydrazine and a 50 per cent. solution of acetic acid, a brown, amorphous precipitate is formed which consists chiefly of a decomposition product of phenylhydrazine, probably diphenylhydrazine. When, however, the urine contains large quantities of derivatives of glycuronic acid, a phenylhydrazine compound may be obtained, as some of these glycuronic acid compounds are decomposed by heating with acetic acid. Thus, whilst urines containing thymol- or naphthol-glycuronic acid do not give phenylhydrazine compounds, a crystalline substance melting at $200\text{--}215^\circ$ may be obtained from a urine containing mentholglycuronic acid, but in this case, although the urine

slowly reduces Fehling's solution and is slightly laevorotatory, it cannot be fermented. The decomposition of mentholglycuronic acid also takes place when the urine is kept, orcinol and menthol being formed. Urines containing urochloralic acid and more than normal amounts of phenol-, indoxyl-, or scatoxyl-glycuronic acid also yield phenylhydrazine compounds. In all these cases, however, the fermentation test furnishes a trustworthy indication of the presence or absence of sugar.

E. W. W.

Isolation of Glycogen from Horseflesh and Preserved Meats. By G. BREUSTEDT (*Arch. Pharm.*, 1899, 237, 637—659).—Several methods of isolation have been studied, and the properties of the glycogen compared with those of the products formed at the same time from any pepper present in the sausages, &c. The conclusion is drawn that at present it is impossible to isolate glycogen with certainty from sausages containing pepper as well as horseflesh; in any case, the employment of alkalis should be avoided when pepper is present, and water used for the extraction. For all preparations that contain no starch, the use of alcoholic, rather than aqueous, potash is recommended in order to extract the glycogen.

The method is as follows: The meat is minced finely and freed from fat by kneading it with warm light petroleum, and decanting the latter; 100 grams of it are mixed in a beaker with 25 c.c. water, 100 c.c. of 90 per cent. alcohol, and 7 grams of caustic potash if the meat is fresh, or 10—15 grams if it has been smoked and more or less dried. The whole is then warmed on the water-bath and stirred for 20—60 minutes, until the muscle fibres are destroyed. The now fairly thin liquid is diluted to 350 c.c. with 95 per cent. alcohol, and allowed to remain at 40° until the solid matter has settled; the liquid is decanted through a plug of glass wool, and the residue washed twice with 50—75 c.c. of alcohol (60 per cent. by vol.). The glass wool is now placed in the beaker, the alcohol remaining evaporated off, the residue mixed with 25 c.c. of water, acidified with hydrochloric acid, and treated with Brücke's reagent (*Sitzungsber. Wien. Akad.*, 1871, Abt. II., Bd. 63) until a further addition of this produced no precipitate. The precipitate is collected and washed with a little water containing a few drops of hydrochloric acid and Brücke's reagent, the filtrate precipitated with twice its volume of 95 per cent. alcohol, and filtered after a little while. The filter is then perforated, the precipitate rinsed with a little hot water into a beaker, the liquid acidified with hydrochloric acid when cold, and treated with a few drops of potassium mercuriodide solution, to precipitate any proteids still present, filtered, the precipitate washed as before, the filtrate mixed with twice its volume of alcohol, and the precipitate of glycogen collected at once on a filter (previously dried at 110° and weighed), washed first with 95 per cent. alcohol, and then with ether, dried at 110°, and weighed.

C. F. B.

Estimation of Glycogen, and Relative Quantities of Glycogen in Different Parts of the Flesh of the Horse. By JOHN K. HAYWOOD (*J. Amer. Chem. Soc.*, 1900, 22, 85—93).—50—60 grams of ground meat are heated with 300 c.c. of a 1 per cent. solution of potassium

hydroxide for 6 hours on the water-bath, water being added from time to time so as to keep the volume of the liquid at 150 c.c. Dilute hydrochloric acid (1 : 5) is now added until the liquid is slightly acid and solution of mercuric potassium iodide (a 10 per cent. solution of potassium iodide saturated with mercuric iodide at boiling heat) is added so long as a precipitate is formed. The whole is diluted to 500 c.c., well shaken, and 250 c.c. collected by filtering through a fluted filter. After adding a drop or two of phenolphthalein, the liquid is neutralised with potassium hydroxide, the amount used being noticed; if a precipitate forms, the liquid must be again filtered and an aliquot part of the filtrate collected, 3—4 drops of hydrochloric acid added, and then twice the volume of 95 per cent. alcohol. After a few hours, the glycogen is collected on a filter, washed first with 60 per cent., then with 95 per cent. alcohol, and finally with ether. The filter is dried at 105° and weighed; the glycogen is now extracted with boiling water and after drying at 115°, the filter is reweighed. Tables are given showing the amount of glycogen in the various parts of the carcase of the horse.

L. DE K.

New Method for the Estimation of Acetic Acid in Vinegar. By DURIEU (*J. Pharm.*, 1900, [vi], 11, 22—23).—As the ordinary methods for the estimation of acetic acid in vinegar are not applicable when the liquid is highly coloured, the following method has been devised. 6 c.c. of a solution of sodium hydrogen carbonate (1/20) are introduced into a graduated tube, then 6 c.c. of alcohol (95°) are carefully added, care being taken that the liquids do not mix. 1 c.c. of a 7 per cent. solution of acetic acid is next added, the tube closed with the thumb, shaken and inverted over water, and the volume of gas evolved is noted. A similar experiment is made with the vinegar, and from the volume of gas evolved and the data obtained in the first experiment, the percentage of acetic acid is readily calculated. It is, of course, essential that the vinegar should contain no other acid than acetic acid.

H. R. LE S.

Estimation of Oxalic Acid in Acid Beet Leaves. By KARL BÜLOW (*Chem. Centr.*, 1900, i, 374; from *J. Landw.*, 47, 359—367).—This is a slight modification of Schloesing's process. 5 grams of the leaves are rubbed in a mortar with 5 c.c. of 22 per cent. sulphuric acid and 5—6 grams of pumice powder added so as to form a dry mass. The mixture is then placed in an open glass tube plugged at the lower end with cotton wool and extracted with ether. The ethereal solution is put into a beaker containing 50 c.c. of water and heated on the top of a water-oven until the ether has evaporated. The aqueous liquid is filtered, neutralised with ammonia, again acidified with acetic acid, and precipitated with calcium acetate; the precipitated calcium oxalate is freed from sulphate by repeated solution in hydrochloric acid and reprecipitation with ammonia.

L. DE K.

Action of Iodine Solution and Alkaline Permanganate on Uric Acid. By ADOLF JOLLES (*Zeit. physiol. Chem.*, 1900, 29, 193—204).—It has been stated by Kreidl (*Abstr.*, 1893, ii, 558)

that in alkaline solution uric acid can be estimated by adding an excess of iodine solution, and after the lapse of $\frac{3}{4}$ hour, acidifying the mixture and titrating the unabsorbed iodine, but that a shorter time results in the consumption of more iodine. The author shows that the anomaly is due to the fact that uric acid slowly decomposes potassium iodide with liberation of iodine. By allowing the action to proceed for exactly $\frac{3}{4}$ hour, the amount of iodine consumed is proportional to that of uric acid present, but with a prolongation of the time the amount increases, although Kreidl's ratio of 3.5 atoms of iodine to 1 mol. of uric acid was not even approximately attained. The method therefore seems useless for practical purposes. Experiments with Hübl's reagent gave a similar result, but potassium iodide being absent the anomaly noticed above does not occur.

The author confirms the accuracy of Hopkins's method of titrating uric acid with permanganate in acid solutions, but experiments on the action of permanganate in alkaline solutions show that the amount reduced depends (1) on the quantity of permanganate added, and (2) on the length of the boiling, and is, moreover, largely increased by the presence of ammonium carbonate, which, according to Folin's method, is employed for washing the ammonium urate precipitated from urine by ammonium acetate.

M. J. S.

Hübl's Iodine Method for Oil Analysis. By AUGUSTUS H. GILL and WALTER O. ADAMS (*J. Amer. Chem. Soc.*, 1900, 22, 12—14).—A process is described which is quite as easy of execution as the original Hübl method, and has the advantage of giving the true iodine figure.

30 grams of mercuric iodide and 25 grams of iodine are dissolved in a litre of pure absolute methyl alcohol and 30 c.c. of this solution are then used in the test. The results differ slightly from those of Hübl. The average iodine absorption of pure oleic acid is given as 90.2, that of olive oil as 79, of cotton seed oil as 91.9, of prime lard as 71.8, and of neat's-foot oil as 55.8 per cent.

L. DE K.

The Determination of the Iodine Value. By JULIUS LEWKOWITSCH (*Analyst*, 1899, 24, 257—259).—Hübl's process for the iodine value of oils has been modified by Wijs (*Abstr.*, 1898, ii, 412), who recommends using a solution of iodine monochloride in pure glacial acetic acid instead of a solution of iodine and mercuric chloride in alcohol; this solution is infinitely superior to the alcoholic solution as regards stability.

The author now states that both solutions, if carefully applied, give identical results.

L. DE K.

The Meaning of the Acetyl Value in Fat Analysis. By JULIUS LEWKOWITSCH (*Analyst*, 1899, 24, 319—330. Compare *Abstr.*, 1898, ii, 316).—The author has ascertained the acetyl number of many fats, waxes, and oils, and has tabulated the results.

The acetyl value indicates the presence of hydroxy-acids, free

alcohols, oxidised fatty acids, and unknown acids, to which must be added mono- or di-glycerides and rancid fats. L. DE K.

Rapidity of Saponification of Some Fats. By HANS KREIS and OTTO WOLF (*Chem. Centr.*, 1900, i, 376; from *Zeit. Unters. Nahr.-Genussm.*, 2, 914—915).—By means of Henriques' cold saponification process, the progress of the reaction being investigated at fixed intervals, it has been proved that there is no appreciable difference in the rate of saponification of butter and margarine. The saponification of beef-tallow proceeds the most quickly. Olive oil, during the first hour, is saponified more slowly, but afterwards more rapidly, than butter. L. DE K.

Analysis of Milk. By L. GALLIEN (*J. Pharm.*, 1900, [vi], 11, 61—64).—In the estimation of lactose in milk by the ordinary polarimetric method, quite an appreciable error is introduced by the fact that the milk serum examined is regarded as occupying the same volume as the original milk, and no account is taken of the volume occupied by the casein, albumin, and butter fat. A simple method of analysis, and a formula and a set of tables are given, by the use of which the true percentage of lactose in milk may be determined. H. R. LE S.

Modification of Duclaux's Method for Estimating Total Solids and Fat in Milk. By UMBERTO MORINI (*Chem. Centr.*, 1900, i, 69; from *Staz. sper. agrar. ital.*, 32, 517).—Duclaux's method (*Le lait*, 1887, 20, 176), and *Principes de lacterie*, 111, 258) is especially suitable for butters containing much water and proteids. The author prefers, however, to work with 20 grams of substance, and to extract the fat with Förster's apparatus (*Zeit. anal. Chem.*, 1888, 27, 30). M. J. S.

Estimation of Fat in Milk. By R. LÉZÉ (*Chem. Centr.*, 1900, i, 69; from *Ann. chim. anal. appl.*, 4, 371).—8 grams of caustic potash are dissolved in 10 c.c. of pure ammonia, 55 c.c. of ethyl alcohol, and 15 c.c. of amyl alcohol are added, and the mixture made up to 100 c.c. with ammonia. 36 c.c. of the milk and 10 c.c. of the above mixture are placed in a 50—60 c.c. flask which has a narrow neck graduated in tenths of a c.c., and after heating for 10 minutes in boiling water, the clear fat is driven up into the neck by adding water, and its volume read off at 40°. As milk fat has an average density of 0.9 at 40°, one-fourth of the volume gives grams of fat per litre of milk; the results agree well with those obtained by extraction. M. J. S.

Changes in the Constants of Butter Fat under the Influence of Feeding. By A. RUFFIN (*Chem. Centr.*, 1900, i, 69—70; from *Ann. chim. anal. appl.*, 4, 383).—The author finds numerous analytical anomalies in Baumbert and Falke's work (*Abstr.*, 1899, ii, 689). His own observations on the influence of feeding with various kinds of oil-cake on the composition of the butter, originally published in 1890, gave the following numbers:

	Refraction.	Saponification number.	Volatile fatty acids.
Ordinary fodder, hay, lucerne...	30 —33	224 —232	27·6—34·9
Cotton-seed cake	28·5—30	222 —228	26·4—29
The same, with ordinary fodder	29·5—30	221 —229	28·4—30
Earthnut cake	30 —31	225 —228	26·9—29
The same, with ordinary fodder	28 —30	221·9—229	28 —32
Cocconut oilcake	32 —33	231 —240	25·5—31
			M. J. S.

Testing Margarine and Butter for Sesamé Oil. By HERMANN BREMER (*Chem. Centr.*, 1900, i, 374—375; from *Pharm. Zeit.*, 45, 7—8).—A controversy with Soltsien on the value of the furfuraldehyde test for sesamé oil. If the reagents are pure, the process is not likely to cause error. L. DE K.

Testing Margarine and Butter for Sesamé Oil. By PAUL SOLTSIEN (*Chem. Centr.*, 1900, i, 375; from *Pharm. Zeit.*, 55, 25—26).—A reply to Bremer (preceding abstract). The author states that the colour produced by furfuraldehyde and hydrochloric acid is not always due to sesamé oil. L. DE K.

Halphen's Reaction and its Application to the Estimation of Cotton-seed Oil. By CASIMIR STRYZYROWSKI (*Chem. Centr.*, 1900, i, 373; from *Pharm. Post*, 32, 736—738).—The author confirms the trustworthiness of Halphen's test; it may be used also for the estimation of cotton-seed oil in other oils. 2 c.c. of the fat and 2 c.c. of the reagent are heated on a boiling water-bath for 45 minutes, the residue is diluted with carbon disulphide to 6 c.c., and the depth of the red coloration compared with that produced by a mixture of known composition under the same conditions. If, however, the added cotton-seed oil has been heated to 200°, the estimation is no longer trustworthy.

The active principle which causes the reaction is not removed from the oil by animal charcoal. If cotton-seed oil is treated with Bechi's reagent until this no longer gives a reaction, and filtered, the filtrate does not give the Halphen test. L. DE K.

Analysis of Fish Oils [Thranen]. By HENRIK BULL (*Chem. Zeit.*, 1899, 23, 996).—Some kilograms of fatty acids derived from fish oil are distilled in a current of superheated steam at 200°, and then passed through a series of receivers, the temperatures of which are 160°, 140°, 120°, and 100° respectively. Four groups of fatty acids are thus obtained, analytical data of which are communicated.

Four groups of acids may also be obtained as follows. The oil is saponified with solution of potassium hydroxide in absolute alcohol, and the potassium soap crystallised as far as possible. After recovering the fatty acids from the mother liquor, they are treated with alcoholic soda, and further crystals of sodium soap obtained. The mother liquor is now evaporated to dryness, and the residue treated with anhydrous ether, to obtain the sodium salts readily soluble in that solvent; on agitating the ether with water, some remain in solution, whilst others pass into the aqueous layer. L. DE K.

Analysis of Soap. By AL. A. SHUKOFF and K. T. NOGIN (*Chem. Centr.*, 1899, ii, 1140—1141; from *Chem. Rev. Fett.-Harz-Ind.*, 6, 205—207).—4—5 grams of the sample, taken from the centre by means of a cork borer, are quickly weighed in a beaker and gently warmed with 30 c.c. of normal sulphuric acid until the fatty acids are perfectly liquefied. When cold, the aqueous liquid is filtered, and the fatty acids again melted, and treated with 30 c.c. of water, which is afterwards poured through the same filter. The cake is washed thrice with cold water, and then dissolved in alcohol; the solution is evaporated in a weighed dish, and the residue dried for 20 hours at 95—100°. The molecular weight of the acids is then found by dissolving them in 10 c.c. of alcohol, and titrating with normal sodium hydroxide. The acid filtrate is also titrated, and the loss in sulphuric acid represents the total alkali; the difference between this and the alkali required by the fatty acids represents free alkali.

A direct estimation of the water in soap is not advisable.

L. DE K.

Water-softening (or so-called "scouring") Power of Soaps. By FREDERIC W. RICHARDSON and ADOLF JAFFÉ (*J. Soc. Chem. Ind.*, 1899, 18, 998—1001).—2.5 grams of the soap are dissolved in 40 c.c. of diluted methylated spirit (1 proof strength), and this solution is diluted to 250 c.c. The liquid is then added from a burette to 100 c.c. of Clark's standard hardness solution (16 grains of calcium carbonate per gallon) until the lather is permanent for one minute. The authors prefer making the stock solution 10 times the usual strength, and then diluting it before use. An average curd soap gives a reading of 28 c.c.; the foam value or water-softening power of the sample is then expressed by $x = 2800/A$, where A represents the number of c.c. of soap solution required to give the requisite foam. Results are communicated in a table, from which it appears that there is no strict relation between the total fatty acids in soaps and their scouring power.

L. DE K.

Estimation of Formaldehyde. By the VEREIN FÜR CHEMISCHE INDUSTRIE IN MAINZ (*Zeit. anal. Chem.*, 1900, 39, 60—63).—The following procedure is adopted for Romijn's titration by iodine (*Abstr.*, 1897, ii, 166): 30 c.c. of normal sodium hydroxide and 5 c.c. of the dilute formaldehyde solution are placed in a well-stoppered bottle, and $N/5$ iodine (40—70 c.c.) added until the liquid becomes yellow. After shaking for about a minute, the liquid is acidified with 40 c.c. of normal acid, and the residual iodine titrated with $N/10$ thiosulphate. A blank titration should be made.

The estimation by the reaction with an alkali hydroxide, $2\text{HCHO} + \text{NaOH} = \text{HCO}_2\text{Na} + \text{MeOH}$, is recommended in the following form: 50 c.c. of normal sodium hydroxide are placed in a strong, narrow-necked 250 c.c. flask and 5 c.c. of the formaldehyde solution, added. The flask is closed with a rubber stopper and completely immersed in water which is kept for 7 hours at 85—87°; after cooling, the excess of alkali is titrated. Several estimations should be made simultaneously, and only those accepted in which the mixture remains colourless; a yellow coloration would indicate secondary reactions.

The same reaction may be employed for estimating methyl alcohol in formalin, 100 grams of which are cohobated for 2 hours with 700 grams of 2*N* sodium hydroxide, using a condenser cooled by ice to avoid loss of methyl alcohol. The methyl alcohol is then distilled off and its amount ascertained from the density of the distillate. From the total quantity found, that resulting from the formaldehyde present is then deducted. The results are of only approximate accuracy, since secondary reactions cannot be wholly avoided.

Another method depends on oxidation with a standard potassium dichromate solution acidified with sulphuric acid. The mixture (0.5 gram of formaldehyde, 2.952 grams of dichromate, 3.2 grams of sulphuric acid, and 100 c.c. of water) is heated in a sealed tube for 6 hours at 140°, and the unreduced chromate then estimated with potassium iodide and thiosulphate. The methyl alcohol, formaldehyde and formic acid present are all oxidised to carbon dioxide and water, and after deducting the amount of chromate reduced by the two latter, the remainder is calculated into methyl alcohol.

M. J. S.

Estimation of Chloral Alcoholate. By FRANZ SCHMIDINGER (*Monatsh.*, 1900, 21, 36—38).—The author shows that Zeisel's method of estimating ethoxy-groups by treatment with hydrogen iodide, and determining the ethyl iodide formed, will also serve to determine the amount of alcoholate present in impure specimens of chloral hydrate.

R. H. P.

[Detection of] Furfuraldehyde in Beer. By C. HEIM (*Bied. Centr.*, 1900, 29, 71; from *Zeit. ges. Brauwesen*, 21, 155—158).—Test paper for furfuraldehyde is prepared by soaking thick filter-paper in a solution of freshly-distilled aniline (9 parts) in glacial acetic acid (6 parts). The solution must be protected from air and light, and must be frequently renewed. By means of this paper, 1 part of furfuraldehyde can be detected in 1,000,000 parts of beer; 1 part in 100,000 is sufficient to affect the taste of beer.

Whilst furfuraldehyde could be detected in English and Belgian beer, Munich beer was found to be free from it. The process of brewing employed in Munich renders the production of furfuraldehyde impossible. The greater the amount of acid in beer, the more readily is furfuraldehyde detected.

N. H. J. M.

Estimation of Vanillin. By PAUL WELMANS (*Zeit. anal. Chem.*, 1900, 39, 58—60; from *Pharm. Zeit.*, 1898, 634).—A gram of the substance is dissolved in 25 c.c. of alcohol and shaken in a stoppered bottle with 25 c.c. of *N*/2 alcoholic potash until completely dissolved. The excess of potash is then titrated with *N*/2 hydrochloric acid and phenolphthalein. The exact value of the 25 c.c. of potash is estimated under similar conditions, and the difference, multiplied by 0.076, gives the amount of vanillin. Of vanillin sugar, 10 grams are dissolved in 50 c.c. of water, the alcoholic potash is added, and the operation carried on as above. The presence of vanillic acid confuses the end-point. To detect acetanilide, an adulterant frequently employed, 1 gram of vanillin, may be dissolved in 10 c.c. of normal potash; acetanilide remains undissolved unless heat is applied.

M. J. S.

Estimation of Glycyrrhizin in Liquorice Extract. By B. HAFNER (*Chem. Centr.*, 1900, i, 68; from *Zeit. Oesterr. Apoth. V.*, 37, 542).—Ten grams of the coarsely powdered extract are warmed for several hours with 200 c.c. of 95 per cent. alcohol and 25 c.c. of *N* sulphuric acid, and the insoluble matter is washed with alcohol. The filtrate, made feebly alkaline with ammonia, and diluted with an equal volume of water, is evaporated, made up to 100 c.c. with water and a few drops of ammonia, filtered, and precipitated with dilute sulphuric acid. The precipitated glycyrrhizin is washed with 2—3 per cent. sulphuric acid, dried in the desiccator, and then extracted with acetone on the water-bath. After adding water and barium carbonate, the acetone is expelled on the water-bath, the residue digested with 200 c.c. of hot water, and the filtered solution evaporated, dried at 100°, and weighed. The barium glycyrrhizate thus obtained should contain 18.76 per cent. of barium, which may be confirmed by evaporating with sulphuric acid, and igniting. M. J. S.

The Florence Reaction. By HEINRICH STRUVE (*Zeit. anal. Chem.*, 1900, 39, 1—8).—The iodine reaction proposed in 1895 by Florence for the medico-legal detection of stains produced by spermatie fluid has no special character, but is produced by all substances of the choline group, such as betaine, neurine, muscarine, amanitine, sinalbin, sinigrin, &c. The mode of using the reagent must be varied somewhat according to the substance under examination, but the general method is as follows. A few drops of an aqueous solution or extract of the substance are dried at 100° on an object glass, then moistened with a solution containing 6 parts of potassium iodide and 2 parts of iodine in 100 parts of water, and, after the superposition of a cover-glass, observed with a magnifying power of 70. After a few moments, peculiar, brownish-black crystals are seen. Should no result be obtained, the experiment is repeated with addition of some dilute hydrochloric acid. In other cases, special methods are necessary for obtaining the reaction. The reaction has been observed with nasal mucus, phlegm, blood, ethereal extract of yolk of egg evaporated with hydrochloric acid for the decomposition of the lecithin, and with many substances of vegetable origin, such as extracts of black and white pepper, *Penicillium glaucum*, *Secale cornutum*, extracts of leaves, flowers, and fruits, and even with wine. From coffee berries, and the leaves of *Erythroxylon coca*, however, no crystals could be obtained. Nothing is known as to the composition of the brown crystals, as their existence is extremely ephemeral. Their growth can be followed under the microscope, but as soon as they reach a maximum size they begin to liquefy and disappear. They can be reproduced as often as desired by redrying the preparation and treating afresh with the reagent. These facts indicate the great stability and wide distribution of substances of the choline group. M. J. S.

General and Physical Chemistry.

Chemical Action of Light contrasted with that of the Silent Electric Discharge. By MARCELLIN P. E. BEETHÉLOT (*Ann. Chim. Phys.*, 1900, [vii], 19, 150—154. Compare Abstr., 1897, i, 330; 1898, ii, 393; 1899, i, 657; ii, 1, 197; and this vol., i, 3).—Benzene remains unaltered when exposed to bright sunlight for several months in sealed tubes containing hydrogen or argon, although it combines with oxygen, yielding resinous products; if placed over mercury, a brown sediment, which is derived from the thiophen present in the hydrocarbon, forms at the junction of the liquids. Carbon disulphide, under these conditions, undergoes a partial decomposition, and the sides of the containing vessel become coated with a brown deposit; when exposed to diffused light, it remains unaltered, and does not react with hydrogen or argon.

When a mixture of argon and gaseous carbon disulphide is submitted to the action of the silent electric discharge for three months in diffused light, the electrodes being maintained at a difference of potential of 200 volts, the former gas remains unaltered, whilst 60 per cent. of the latter is converted into yellow, resinous products. G. T. M.

Influence of Pressure on the Rotation of Solutions of Sucrose. By L. H. SIERTSEMA (*Arch. néerland sci. exp. nat.*, 1899, [ii], 3, 79—87).—The rotations of solutions of sucrose at various pressures were determined, plates of quartz being used to partially compensate the rotation of the solution and render small variations more evident. The variation of rotation for 100 atmospheres pressure are then calculated, and corrections introduced for the variation of rotation of the quartz, after which the variation of rotation per centimetre is calculated. This is dependent on the variation of concentration and of specific rotation, and, of these, the first is calculable from Amagat's compressibility values. The values so obtained are as follows, where c is concentration, k the internal pressure according to Tammann, $\Delta c/c$ the concentration change, $\Delta\beta/\beta$ the change of rotation per cm., and $\Delta\gamma/\gamma$ the change of specific rotation $= \Delta\beta/\beta - \Delta c/c$.

c .	k .	$\Delta c/c$.	$\Delta\beta/\beta$.	$\Delta\gamma/\gamma$.
9.48	238	0.00449	0.00268	-0.00181
18.70	465	0.00418	0.00252	-0.00166
27.84	669	0.00398	0.00270	-0.00128

If, as Tammann supposes, the variations of specific rotation with concentration are due to variations of internal pressure, then, by the use of the above values for $\Delta\gamma/\gamma$, the internal pressure of the solutions is calculable, but the values do not agree with those obtained by Tammann by other methods; the author, however, makes no attempt to estimate the undoubtedly great probable error in the above values of $\Delta\gamma/\gamma$. In many cases, the variations of rotation consequent on the addition of an inactive salt are completely explicable on Tammann's hypothesis, but, as agreement is not found in all cases, the author

considers that Tammann's theory is insufficient to explain the changes of rotation (compare Tammann, *Abstr.*, 1896, ii, 13, 289, and previous abstracts).
L. M. J.

Spectrum of Bromine. By JOSEF M. EDER and EDUARD VALENTA (*Chem. Centr.*, 1900, i, 453; from *Denkschr. math.-nat. Klasse K. Akad. Wiss. Wien.*, 1—8).—The line spectrum is most distinct with a pressure of 8—10 mm.; when the pressure is lowered, the spectrum becomes faint, and when the pressure is raised, there is marked broadening of the lines. Besides this line spectrum, a continuous spectrum was observed in the violet also at low pressures. A third spectrum was observed at a pressure of 45 mm., corresponding probably with the normal band spectrum of other elements. The authors consider the line spectrum especially characteristic.
J. C. P.

Fluorescence of Metallic Compounds under the Influence of Röntgen and Becquerel Rays. By PAUL BARY (*Compt. rend.*, 1900, 130, 776—778).—The author has examined a large number of salts under the influence of the Röntgen rays; those which become fluorescent belong, with the exception of uranium, to the families of the alkalis and alkaline earths; of these salts, the halogen compounds appear to always become fluorescent, but many other salts may be inactive. Similar results were obtained by exposure to the radiations from a radio-active metal supplied by Curie (compare this vol., ii, 82, 126), and these are also probably radiations of very short wave-length. The permanent luminescence of some barium salts may be due to the action of the Becquerel rays on the barium salt itself, or to the fluorescence of contained radium.
L. M. J.

Nature of Electrocapillary Phenomena. I. Their Relation to the Potential Differences between Solutions. By S. W. J. SMITH (*Phil. Trans.*, 1899, A, 193, 47—87; also *Zeit. physikal. Chem.*, 1900, 32, 433—476).—The Lippmann-Helmholtz theory of the capillary electrometer contains two assumptions. According to the first, the variation of the potential difference at the capillary electrode of an electrometer is the same as that of the applied E.M.F. To test this, the effect of depolarisation has been investigated and determined. The second assumption, that electrocapillary phenomena depend simply on the variation of the electrostatic surface energy, leads to difficulties, for (1) the form of the electrocapillary curve is remarkably dependent on the nature and concentration of the electrolyte; (2) if it be assumed that the potential difference between the solution and the capillary electrode is zero when the surface tension is a maximum, large potential differences must exist between certain solutions.

According to the Nernst-Planck theory, the potential difference between equally concentrated solutions of potassium chloride and potassium iodide is negligible; with this conclusion, the first assumption of the Lippmann-Helmholtz theory is in accord. Combination of the two hypotheses shows that the surface tension of mercury (for a certain range of potential differences) in two solutions is the same for a given potential difference between the mercury and the respective solutions, if they are equally concentrated and possess the same

cation; it is further shown that it is immaterial whether the cation be K, Na, or H.

The work described in the paper points to the first assumption of the Lippmann-Helmholtz theory being correct, and the second incorrect; the electrocapillary curves are never completely free from influences other than electrostatic. J. C. P.

Potential Differences with Manganese Dioxide Electrodes. By OLIN F. TOWER (*Zeit. physikal. Chem.*, 1900, 32, 566—577).—Experiments are recorded supplementing the author's previous work (Abstr., 1896, ii, 142) and that of Smith (Abstr., 1897, ii, 5). The

concentration of the H^+ ions in a solution at a manganese dioxide electrode is found to have about four times as much influence on the

E.M.F. as the concentration of the Mn^{++} ions. A number of experiments have been made to determine by this method the dissociation of numerous dibasic organic acids, but the author concludes that the method is not exact. The differences between the results actually obtained and those theoretically deducted cannot be satisfactorily explained. J. C. P.

Dielectric Constant of Hydrogen Peroxide. By HARRY T. CALVERT (*Ann. Phys.*, 1900, [iv], 1, 483—485).—The dielectric constant of a 45.9 per cent. solution of hydrogen peroxide, as determined by one of Drude's methods (Abstr., 1897, ii, 438), has the value 84.7 at 18°. If the density of pure hydrogen peroxide is taken as 1.5 (see Abstr., 1895, ii, 346), the application of the mixture rule gives 92.8 as the dielectric constant of pure hydrogen peroxide. The fact that this compound has a considerably greater dielectric constant than water, and that it shows no anomalous electrical absorption, agrees with the views of Brühl, who supposes hydrogen peroxide to contain no hydroxyl groups, and has predicted for it a large dielectric constant on account of free valency (Abstr., 1896, ii, 162; 1897, ii, 198). J. C. P.

Effect of Suspended Particles on Conductivity. By MAX. OKER-BLOM (*Pflüger Arch.*, 1900, 79, 510—533. See this vol., ii, 356).

Electrolytic Conductivity and Internal Friction in Saline Solutions. By P. MASSOULIER (*Compt. rend.*, 1900, 130, 773—775).—Although electrolytic conductivity and internal friction have been found to vary in the same sense, yet no quantitative proportionality has been found, and in almost all the experiments hitherto made the variations of friction have been very slight. The author therefore measured the conductivity and internal frictions of solutions of copper sulphate in water and aqueous glycerol in which great variations of internal friction are obtainable. Determinations were made at 0° and at 15° with the following results for the latter temperature.

Glycerol.	Resistance.	Internal friction.
0	100	100
1/48	104	105
1/24	111	114
1/12	126	132
1/6	161	160
1/3	289	298

The agreement is also stated to be very satisfactory for solutions of the halogen compounds of sodium and potassium. L. M. J.

Conductivity of some Sodium Derivatives of Nitroparaffins.

By OTTOKAR ŠULC (*Zeit. physikal. Chem.*, 1900, 32, 625—629).—Nitromethane, nitroethane, nitropropane, and nitroisopropane are found to be compounds of acidic character, for their sodium derivatives in aqueous solution are good conductors. The following results were obtained:

	μ_{1000}	μ_{25}
$\text{CH}_3\text{Na}\cdot\text{NO}_2$	108.6	84.4
$\text{CH}_3\cdot\text{CHNa}\cdot\text{NO}_2$	81.9	69.0
$\text{CH}_3\cdot\text{CH}_2\cdot\text{CHNa}\cdot\text{NO}_2$	80.8	67.8
$\text{C}(\text{CH}_3)_2\text{Na}\cdot\text{NO}_2$	93.1	65.0

The numbers for the last compound are somewhat uncertain.

J. C. P.

Finding the Ionisation of Complex Solutions of given Concentration, and the Converse Problem. By JAMES G. MACGREGOR (*Chem. Centr.*, 1900, i, 390—391; from *Trans. Nova Scot. Inst. Sci.*, 10, 67—78).—Two electrolytes in mixed solution and containing a common ion may be supposed to occupy distinct portions or regions of the solution: on this supposition, the equations are deduced:—(1) $a_1/V_1 = a_2/V_2$; (2) $N_1V_1 + N_2V_2 = 1$; (3) $a_1/V_1 = f_1(V_1)$; (4) $a_2/V_2 = f_2(V_2)$, where a_1 and a_2 are the ionisation coefficients of the two electrolytes, N_1 and N_2 their concentrations, V_1 and V_2 their regional dilutions in litres per gram equivalent. The functions f_1 and f_2 are very complex, and the equations cannot be solved algebraically. The present paper shows how, by a graphic method, the ionisation in a mixed solution may be calculated from the concentrations, and, conversely, how the composition of the solution may be calculated when the degree of dissociation is given. This method of calculation is compared with those of Schrader and Kay.

J. C. P.

Conductivity, Specific Gravity, and Surface Tension of Aqueous Solutions containing Potassium Chloride and Sulphate. By JAMES BARNES (*Chem. Centr.*, 1900, i, 391; from *Trans. Nova Scot. Inst. Sci.*, 10, 49—66).—The methods given by MacGregor for calculating the conductivity (compare previous abstract) and other properties of a mixed solution of two electrolytes have been tested by the author. It is found that the values for the conductivity, sp. gr., and surface tension of mixed solutions of the above-named salts agree within the limits of experimental error with those calculated from the properties of the separate solutions.

J. C. P.

Electrolytic Decomposition Point of Aqueous Solutions.

By ALBERT GOCKEL (*Zeit. physikal. Chem.*, 1900, 32, 607—624).—When a gradually increasing E.M.F. is applied to the electrodes of an electrolytic cell, there is, according to Le Blanc (*Abstr.*, 1891, 1405; 1894, ii, 4), a definite point at which decomposition of the electrolyte begins, as evidenced by a sudden increase of the current passing through the circuit. The author's experiments, made with different

electrolytes and under varying conditions, show that in the curves connecting the applied E.M.F. with the current passing through the cell there is absolutely no distinct break. He regards the so-called E.M.F. of decomposition as in no way characteristic of the particular ion involved, but supposes it to depend on the conditions, and to be the point at which the electrolysis first becomes evident; possibly it is the point at which the products of the electrolysis begin to react with the solvent, the dissolved gases, or the electrode. J. C. P.

Electrolysis of Fused Salts. By RICHARD LORENZ [with A. HELFENSTEIN] (*Zeit. anorg. Chem.*, 1900, 23, 97—110. Compare Abstr., 1900, ii, 61).—An investigation of this subject from the point of view of Faraday's law shows the great importance of keeping the electrodes apart, and indicates the conditions under which trustworthy values of the E.M.F. of polarisation and its temperature coefficient can be obtained (compare Abstr., 1899, ii, 267, 724). The current yield in the electrolysis of fused lead chloride diminishes rapidly as the temperature rises, having the value zero at the boiling point of the salt; this rapid fall is due, not only to the accelerated diffusion of the lead and chlorine vapour in the fused mass, but also to the increasing vapour tension of the lead. At constant temperature, the yield increases with the current density and with the distance between the electrodes; it diminishes as the depth of immersion of the anode increases, whilst it is almost quantitative when the anode is quite separated from the cathode. From the above results, it follows that a tube with the electrodes close together is an unsuitable and uneconomical form of apparatus for the electrolysis of fused salts; in such an arrangement, the longer the experiment lasts the poorer is the percentage yield, owing to the more complete diffusion of the products. J. C. P.

Molecular Susceptibility of the Salts of the Rare Earths. By H. DU BOIS and OTTO LIEBKNECHT (*Ber.*, 1900, 33, 975—977. Compare this vol., ii, 127).—In reply to the criticism of Meyer (this vol., ii, 186), the authors point out that the agreement between the numbers obtained by them and those obtained by Meyer is satisfactory in view of the fact that different methods were employed. It is probable that the observed paramagnetism of the yttrium compounds is in reality due to the presence of erbium compounds. A. H.

Thermal Conductivities of Mixtures and of their Constituents. By CHARLES H. LEES (*Phil. Mag.*, 1900, [v], 49, 286—293).—Three expressions have been used to connect the conductivity of a mixture of two components with the separate conductivities. Of these, one is an expression for the conductivity itself, the second for the inverse, or the resistivity, and the third for the logarithm of the conductivity, each being a simple mixture formula; these formulæ correspond with various modes of disposition of the components in the mixture. In order to test the relative values of the three expressions, the author has compared the calculated values with the found values in the case of the following mixtures, tin-bismuth, water-ethyl alcohol, water-glycerol, water-acetic acid, water-methyl alcohol, glycerol-ethyl

alcohol, vaselin-marble, lard-zinc sulphate; it was found that the conductivity formula is the most, and the logarithmic formula the least, unsatisfactory. The latter gives in general values which are too high, the resistivity formula yields values too low. An empirical formula, $k^n = (p_1 k_1^n + p_2 k_2^n) / (p_1 + p_2)$, gives values in fair accord with the determinations, where n is an arbitrary constant.

L. M. J.

Bunsen's Ice Calorimeter. By J. W. MELLOR (*J. Physical Chem.*, 1900, 4, 135—136).—To fill the ice calorimeter with water free from air, the author gives the following method. The calorimeter about one-third full of distilled water is connected with a tube dipping under water contained in a distilling flask with condenser connected to a pump. The calorimeter and flask are heated with the pump in action until the water gives the 'click' of air-free water. The calorimeter is then allowed to cool, and fills with the air-free water.

L. M. J.

Heat of Combustion of very Volatile Liquids. By MARCELLIN P. E. BERTHELOT and MARCEL DELÉPINE (*Compt. rend.*, 1900, 130, 1045—1049).—The following values were obtained by burning the substances in a calorimetric bomb containing oxygen under a pressure of 25 atmospheres:

	Molecular heat of combustion in calories		Heat of formation.
	at constant volume.	at constant pressure.	
Acetaldehyde	278·86	279·16	47·45
Methylal	461·9	462·5	96·4
Methyl formate ...	233·2	233·2	93·4
Ethyl formate ...	391·4	391·7	98·2
Propaldehyde	433·8	434·35	55·55
Acetone	426·3	426·9	63·0

The calculated values for formation from the elements, carbon (diamond), hydrogen (gas), and oxygen (gas) are also given.

H. R. LE S.

Heat of Vaporisation of Nitriles and other Organic Compounds. By WLADIMIR LUGININ (*Chem. Centr.*, 1900, i, 451; from *Arch. sci. phys. nat. Genève*, 9, 5—26).—The constants previously recorded (*Abstr.*, 1899, ii, 354) are supplemented by the following:

Compound.	Specific heat.		Heat of vaporisation.	$\frac{MS}{T}$
	Limits.	Value.		
Propionitrile ...	19·2—95·1°	0·5378	134·40	19·97
Benzonitrile ...	21 —186	0·4412	87·71	19·47
Acetophenone...	20 —196	0·4744	77·24	19·44
m-Cresol	21 —197	0·5534	100·46	22·86
Acetic acid	22·5—111·4	0·5323	89·79	13·74

In the above table, M is the molecular weight, S the heat of vaporisation, and T the boiling point on the absolute scale. The first three compounds give a value for the expression MS/T approximately = 20, and are therefore not polymerised, although Ramsay and Shields found that propionitrile molecules polymerised. The high value obtained for m-cresol points to polymerisation on the part of

this compound. The author finds for the heat of vaporisation of acetic acid a value considerably greater than that (84.9) obtained by Berthelot and Ogier. If 80 be added to the value of S for acetic acid, corresponding with the change from double to single molecules, the expression $MS/T = 26.28$.

J. C. P.

Freezing Point of Aqueous Solutions of Non-electrolytes. By ELMER H. LOOMIS (*Zeit. physikal. Chem.*, 1900, 32, 578—606).—The author considers that his earlier method of determining the freezing point of dilute solutions (*Ann. Phys. Chem.*, 1893, [ii], 51, 500) satisfies the condition that the convergence temperature of the apparatus agrees with the true observed freezing point. In the earlier experiments, the thermometer, when not in use, was kept completely surrounded with ice; this procedure is now regarded as an error, as only the lower part of the thermometer should be so preserved.

The author finds the value of van't Hoff's constant in dilute solutions of propyl alcohol, butyl alcohol, amyl alcohol, glycerol, acetone, dextrose, sucrose, mannitol and aniline to be 1.86; abnormal values are found for methyl alcohol (1.82), ethyl alcohol (1.84), and ether (1.50).

J. C. P.

Freezing Point Curve for Water containing Hydrogen Chloride and Phenol. By J. A. EMERY and FRANK K. CAMERON (*J. Physical Chem.*, 1900, 4, 130—134).—The freezing point of a saturated aqueous solution of phenol was found to be -1.179° . By the addition of hydrogen chloride, a linear freezing point curve is obtained for dilute solutions, the molecular depression being 3.648, whilst in pure water it was found by Jones to be 3.630. It follows that the effects of the two compounds in producing cryoscopic depression are purely additive.

L. M. J.

Minimum Volume of Liquids. By DANIEL BERTHELOT (*Compt. rend.*, 1900, 130, 713—716).—If a curve be drawn with the values of the mean of the densities of liquid and saturated vapour as ordinates, and with temperatures as abscissæ, the result is a straight line, and since at the absolute zero the density of the saturated vapour may be regarded as zero, it follows that by the prolongation of this line the value of the density of the liquid at absolute zero is obtained and hence also the volume which may be regarded as the minimum volume. The minimum volumes so obtained are given for nitrogen, oxygen, chlorine, bromine, carbon dioxide, sulphur dioxide, ethylene, carbon tetrachloride, stannic chloride, ethyl ether, benzene, fluorobenzene, chlorobenzene, bromobenzene, iodobenzene, pentane, isopentane, hexane, and heptane. The examination of these values is deferred, but the author states that the chief point of interest is that if the volumes are measured from these minima and a different zero of temperature be taken for each compound, then the discrepancies from the law of corresponding states disappear (see also Guldberg, this vol., ii, 264; Meyer, this vol., ii, 263).

L. M. J.

Dissociation of Dissolved Substances. I. By AD. VANDENBERGHE (*Chem. Centr.*, 1900, i, 391; from *Bull. Acad. med. Belg.*, [iii], 37, 657—679).—Freezing point and boiling point methods give

values for the molecular weight which are often too low on account of dissociation, or too high on account of association. The author, in determining the influence of temperature and concentration on these phenomena, uses chemically similar solvents, namely, methyl, ethyl, and propyl alcohols. The molecular weights of picric acid, naphthalene and carbamide have been determined in these solvents by a boiling point method. The extent of dissociation increases as the boiling point of the solvent rises, and the extent of association increases with the concentration of the dissolved substance.

J. C. P.

Viscosity of Solutions. By R. HOSKING (*Phil. Mag.*, 1900, 49, 274—286).—The apparatus and method of observation employed were essentially similar to those used by Thorpe and Rodger (*Phil. Trans.*, 1894), and the accuracy of the determinations is seen by the close agreement of the results for water with those of Thorpe and Rodger, Slotte, Sprung, and Poiseuille. Solutions of (1) sodium chloride, and (2) sucrose, were examined, these being selected as typical electrolytic and non-electrolytic solutions; the results are as follows:

(1) Sodium chloride.

Temp.	0 per cent.	5 per cent.	10 per cent.	20 per cent.
0°.....	0·01794	0·01862	0·02041	0·02666
20	0·01009	0·01083	0·01194	0·01540
50	0·00553	0·00614	0·00680	0·00866
90	0·00320	0·00355	0·00401	0·00507

(2) Sucrose.

	5 per cent.	10 per cent.	20 per cent.	40 per cent.
0°.....	0·02048	0·02436	0·03720	0·1476
20	0·01139	0·01328	0·01910	0·0607
50	0·00611	0·00699	0·00961	0·02410
90	0·00349	0·00389	0·00511	0·01093

L. M. J.

Drop Methods for the Determination of Molecular Weights. By G. ROSSER (*Bull. Soc. Chim.*, 1900, [iii], 23, 245—250).—The variation of the surface tension of solutions is proportional to the molecular concentration of the solute, and hence the measurement of the constant is of use for the determination of molecular weights. The author has studied the drop method with the object of finding its availability as a speedy and accurate process. The weights of a hundred drops and also of equal volumes of the solutions were determined, and hence the number of drops in equal volumes can be found. These numbers are inversely proportional to the capillary constants f/d , where f is surface tension and d the density, and vary as a linear function of concentration, so that $1/n_1 = 1/n - kx$ where x is the concentration. In the case of sodium chloride solutions, this expression was verified for concentrations up to 10 per cent. at 23°, and to 30 per cent. at 24°; above 20 per cent., the accord between the determinations and calculated values is not satisfactory, so that the expression does not hold at these high concentrations. It was found that the pressure has a great effect on the number of drops, the weight of 100

drops of water decreasing from 8.192 grams to 7.570 grams when the pressure rose from 29 mm. to 150 mm. of water. The time of dropping was found to be approximately inversely proportional to the pressure. Owing to the great effect of pressure, it is necessary that all experiment for the determination of molecular weights be made at a constant pressure.

L. M. J.

Molecular Association in Liquids. By DANIEL BERTHELOT (*Compt. rend.*, 1900, 130, 565—568).—By the assumption of the law of corresponding states, it is possible from the values of the critical temperature and pressure, and the value of the density at some other temperature and pressure, to calculate the mol. weight of the compound. The ratio of the mol. weight so obtained to the true value is equal to, greater than, or less than unity according as the compound is normal, associated, or dissociated. Thus, for carbon disulphide, values of from 0.96 to 0.97 are obtained, and for ethyl chloride of from 0.98 to 0.99, hence these are normal. For methyl, ethyl, and propyl alcohols, the values are respectively 1.256, 1.115, and 1.116, so that these compounds are associated. It is not found that the values alter with temperature and pressure, so that the factors of association of these compounds are regarded as practically constant through the whole range of the liquid state; water, however, exhibits considerable differences of association.

L. M. J.

Chemical Reactions in Solution: Vapour Tension of the Solvent. By A. PONSOT (*Compt. rend.*, 1900, 130, 782—785).—By the consideration of a cycle of reversible operations in a homogeneous mixture, the author obtains the following deductions. When spontaneous reactions, taking place at constant pressure and temperature amongst dissolved substances or mixtures modify the system, they cause: (1) an increase to a maximum of the vapour pressure of the solvent, if it takes no part in the reaction; (2) an increase of that of a produced compound, and conversely. It also follows that the sense of the chemical change of a system not in equilibrium is independent of the nature of the solvent.

L. M. J.

Equilibrium in the Partition of an Acid between Zinc Hydroxide and Ammonia. By W. HERZ (*Zeit. anorg. Chem.*, 1900, 23, 222—227).—The equilibrium represented by the scheme, $\text{Zn}(\text{OH})_2 + 2\text{NH}_4\text{Cl} \rightleftharpoons \text{ZnCl}_2 + 2\text{NH}_4\text{OH}$, is analogous to that between manganous salts and ammonia (*Abstr.*, 1899, ii, 752; 1900, ii, 68). The law of mass action leads to $K = [\text{Zn}^{++}]^{1/2}/[\text{NH}_4^+]$, but the values of K obtained from this equation are not constant; the relation, $K = [\text{Zn}]/[\text{NH}_4]$, is more nearly satisfied by the results obtained, but the values of the constant diminish slightly with falling concentration. In more dilute solutions, the point of equilibrium was approached from the other side, namely, by adding ammonia to zinc salt solutions; fairly constant values were then obtained for the expression $[\text{Zn}^{++}][\text{NH}_3]^2/[\text{NH}_4^+]^2$, except when the ammonia was in excess and gave rise to the formation of complex ions. It is immaterial for the equilibrium whether zinc sulphate or zinc nitrate is employed.

From the experiments the solubility of zinc hydroxide is calculated to be 2.6×10^{-5} , agreeing with Bodländer's value 2.5×10^{-5} .

J. C. P.

Decomposition by Sodium of Organic Halogen Compounds dissolved in Amyl Alcohol. By RICHARD LÖWENHERZ (*Zeit. physikal. Chem.*, 1900, 32, 477—493. Compare Abstr., 1899, ii, 639).—Pieces of sodium were added to solutions of iodobenzene, chlorobenzene, benzyl chloride, isobutyl iodide, bromobenzene, and isobutyl bromide in amyl alcohol; the halogen eliminated and the sodium in solution were subsequently determined by titration. Preliminary experiments showed that the quantity of halogen eliminated was generally proportional (1) to the concentration of the halogen compound, (2) to the quantity of dissolved sodium. This leads to the equation $dx/d(\text{Na}) = k(a - x)$, where (Na) is the dissolved sodium in gram atoms per kilogram of solution, a the initial quantity of halogen compound, x the quantity decomposed; k is a constant. On integration, the equation assumes the form $k = 1/(\text{Na}) \cdot \log a(a - x)$. The initial concentration of the halogen compound was in most cases 0.1 gram-mol. per kilogram of solution, and the values of k obtained were satisfactorily constant within the separate series, except in the case of bromobenzene, which, however, gave constant values for k in more dilute solution. For each of the compounds iodobenzene, chlorobenzene, benzyl chloride, and isobutyl iodide, k has the same value; for isobutyl bromide, it is somewhat smaller. In the case of iodobenzene, k was found to diminish both with rising temperature and with falling concentration of the halogen compound.

J. C. P.

Absorption of Hydrogen Chloride and Potassium Chloride from Aqueous Solution by Colloidal Stannic Oxide. By JACOBUS M. VAN BEMMELN and EDUARD A. KLOBBIE (*Zeit. anorg. Chem.*, 1900, 23, 111—125. Compare Abstr., 1882, 571; 1897, ii, 137; 1899, ii, 12, 84).—Metastannic acid has a very considerable power of absorbing hydrogen chloride from aqueous solution; when equilibrium has been established, the concentration of the hydrogen chloride in the colloid is often greater than that in the aqueous solution. The absorption factor $k = (\text{conc. in colloid})/(\text{conc. in solution})$ is not constant, but is dependent on the concentrations at the point of equilibrium. Metastannic acid has an appreciable power of absorbing potassium sulphate. From solutions of potassium chloride and potassium nitrate, the same colloid absorbs as much salt as makes the concentrations in the colloid and in the solution approximately equal.

J. C. P.

Emission and Absorption of Water Vapour by Colloidal Matter. By PIERRE DUHEM (*J. Physical Chem.*, 1900, 4, 65—122). The author has previously shown that hysteresis plays a very important part in many cases of slow chemical change (Abstr., 1897, ii, 439), and Marchis showed that the variations of the zero in thermometers are due to an expansion hysteresis (Abstr., 1899, ii, 545). The author has investigated theoretically the emission and absorption of aqueous vapour by colloids as an example of hysteresis, and shows that the various phenomena observed by van Bemmelen are in

complete accord with the theoretical deductions (compare Abstr., 1897, ii, 137; 1898, ii, 220; 1899, ii, 12, 84, 487, 599). L. M. J.

Metallic Crystallisation by Electric Currents. By DONATO TOMMASI (*Compt. rend.*, 1900, 130, 565. Compare Tommasina, this vol., ii, 185).—A claim for priority, the author pointing out that, in 1882, he had observed that by the passage of an electric current from silver or copper to platinum through distilled water, a crystalline deposit of the anode metal mixed with oxide was obtained in the tube.

L. M. J.

Formation and Transition of Mixed Crystals of Sodium and Potassium Nitrates, and of Sodium and Silver Nitrates. By D. J. HISSINK (*Zeit. physikal. Chem.*, 1900, 32, 537—563).—From fused mixtures of sodium and potassium nitrates, an interrupted series of mixed crystals is formed, the interval extending from 24—85 mols. per cent. of potassium nitrate at 218°. The existence of mixed crystals is shown by the lowering of the transition temperature of potassium nitrate.

The solidification of fused mixtures of sodium and silver nitrates exemplifies Roozeboom's fourth type (this vol., ii, 132). The freezing point rises gradually from 208·6° for pure silver nitrate to 308° for pure sodium nitrate, with a break at 217·5°, corresponding with 19·5 mols. per cent. of sodium nitrate. To the first part of the freezing point curve there correspond mixed crystals of the AgNO_3 type, containing from 0—26 mols. per cent. of sodium nitrate; to the second part of the curve there correspond mixed crystals of the NaNO_3 type, containing from 38—100 mols. per cent. of sodium nitrate. The interval, 26—38 mols. per cent. of sodium nitrate becomes wider as the temperature falls, and at 138° the limits are 4·5 and ± 50 mols. per cent. of sodium nitrate. The transition temperature of mixed crystals of the AgNO_3 type, as determined by an air dilatometer, falls from 159·8° to 138°, as their molecular composition changes from 0—4 per cent. of sodium nitrate. The gap between mixed crystals of the AgNO_3 type and those of the NaNO_3 type becomes still wider with falling temperature, as shown by solubility experiments in aqueous alcohol; at 15°, the interval extends from 1·6—64·4 mols. per cent. of sodium nitrate.

No transition point could be found for sodium nitrate between +270° and -50°; neither could any sudden transition of the mixed crystals of the NaNO_3 type be detected below 138°. J. C. P.

[Crystalline Liquids.] By RUDOLF SOHENCK (*Zeit. physikal. Chem.*, 1900, 32, 564—565).—A reply to Roozeboom's criticisms (*ibid.*, 1899, 30, 428) on the author's work dealing with enantiotropic and monotropic modifications of azoxyanisole (Abstr., 1899, ii, 637).

J. C. P.

Report of the [American] Committee on Atomic Weights. By FRANK W. CLARKE (*J. Amer. Chem. Soc.*, 1900, 22, 70—80).—A résumé of the work published during 1899 on the atomic weights of boron, nitrogen, calcium, nickel, cobalt, molybdenum, tungsten, cerium,

palladium, radium and copper ; a corrected table of the atomic weights of all the elements is appended. E. G.

Lecture Experiment on the Law of Multiple Proportions. By FRIEDRICH EMICH and FRIEDRICH DÖRNER (*Chem. Centr.*, 1900, i, 579—580 ; from *Zeit. phys.-chem. Unterr.*, 12, 281—282).—When lead dioxide is heated, it loses half its oxygen, and by the action of chlorine on the residual monoxide at a red heat, the remainder of the oxygen is liberated. These decompositions are made the basis of a convenient lecture experiment to illustrate the law of multiple proportions. The air is displaced from the tube containing the dioxide by means of carbon dioxide, and the oxygen evolved on heating is measured in a Schiff's nitrometer over potassium hydroxide solution, the last traces of oxygen being finally driven over by means of carbon dioxide. Chlorine is then passed over the residual lead monoxide, which is raised to a red heat, and the oxygen liberated is again measured as before over potassium hydroxide solution. E. W. W.

New Gasometer of Constant Pressure, Adjustable at Will. By JOSEPH RIBAN (*Bull. Soc. Chim.*, 1900, [iii], 23, 222—226).—In its general appearance, this apparatus resembles the ordinary laboratory gasometer, but differs from the latter in having two water reservoirs, an upper exterior one capable of being fixed at any desired height, and a lower interior reservoir in the upper part of the gas container. The gas is delivered at a constant pressure measured by the difference in height between the levels of the water in the two reservoirs. There are also various minor improvements which facilitate the expulsion of air before filling the gasometer with gas and prevent escape of gas or entry of air resulting from alterations in temperature. N. L.

Inorganic Chemistry.

Preparation and Properties of Anhydrous Perchloric Acid. By DANIEL VORLÄNDER and RUDOLF VON SCHILLING (*Annalen*, 1900, 310, 369—380).—Anhydrous perchloric acid is prepared by distilling potassium perchlorate (50 grams) with 96—97.5 per cent. sulphuric acid (150—175 grams) under 50—70 mm. pressure, and after removing chlorine dioxide by means of a current of air, redistilling the product under the same pressure. The anhydrous acid is colourless, boils at 39° under 56 mm. pressure, and has a sp. gr. 1.764 at 22°/4°; it remains liquid in a mixture of ether and solid carbon dioxide. It does not dissolve in carbon tetrachloride, with which it forms a green emulsion, which soon becomes brown, and evolves hydrogen chloride and phosgene; chloroform, however, dissolves it in every proportion, and on exposing the solution to air, crystals of the monohydrate separate, whilst phosphoric oxide produces a violent explosion. When a few c.c. of benzene are added to a drop or two of perchloric acid, heat is generated, and a brown pre-

precipitate is formed; equal volumes yield a green emulsion, which explodes.

The spontaneous decomposition of anhydrous perchloric acid proceeds when the substance is protected from light and maintained at a low temperature; samples of the purest acid, sealed in glass bulbs, become pale yellow in 2 or 3 days, then gradually brown, and after 3 or 4 weeks the bulbs are shattered by the pressure of the gases evolved in the decomposition.

The authors discuss the action of more concentrated sulphuric acid, and of phosphoric and pyrophosphoric acids on potassium perchlorate.

M. O. F.

Molecular Weight of Sulphur as Determined by the Boiling Point Method. By LOUIS ARONSTEIN and S. H. MEIHUIZEN (*Chem. Centr.*, 1900, i, 392—393; from *Arch. néerland. sci. exp. nat.*, [ii], 3, 89—130).—In solutions, sulphur is found to have a molecular weight corresponding with the formula S_8 , whether above or below its transition and melting points. No importance is to be attached to the molecular weight 64 obtained by Orndorff and Terrasse in disulphur dichloride (*Abstr.*, 1896, ii, 358), since this solvent decomposes at its boiling point.

J. C. P.

Sulphur Perfluoride, SF_6 ; a New Gas. By HENRI MOISSAN and PAUL LEBEAU (*Compt. rend.*, 1900, 130, 865—871).—When sulphur is introduced into a vessel containing fluorine, it immediately takes fire, and burns with a livid flame; the product is gaseous, and consists of at least two compounds, for the mixture, although quite insoluble in water, partly dissolves in an aqueous solution of potassium hydroxide. When the fluorine is in excess, the product contains 80—90 per cent. of the insoluble constituent; the inert gas appears, therefore, to be a perfluoride.

The mixture of sulphur fluorides is liquefied by cooling to -80° , freed from foreign gases by fractional distillation, treated with concentrated potassium hydroxide solution, and finally dried over the fused alkali; the perfluoride thus obtained is freed from traces of nitrogen by liquefaction and fractionation, the latter gas passing off in the first portion of the distillate.

Sulphur perfluoride, SF_6 , is a colourless, inodorous, tasteless, combustible gas, which does not support combustion; it is very sparingly soluble in water, dissolving to a slightly greater extent in absolute alcohol; when cooled to -55° , it solidifies to a white, crystalline mass, which melts and boils at slightly higher temperatures. The perfluoride is a very inert gas, resembling nitrogen more than sulphur chloride; potassium hydroxide, whether fused or in alcoholic or aqueous solution, does not act on it, and it is not affected by lead chromate, copper oxide, silver, copper, phosphorus, arsenic, boron, silicon, or carbon, even at a red heat. Fluorine, and the halogens, ammonia, and hydrogen chloride have no action on the gas, even at high temperatures. No change occurs when the gas is heated alone up to the fusing point of hard glass; at the temperature of the induction spark, however, it is partially decomposed, but even after prolonging the action for over 2 hours, 11 per cent. of the perfluoride remains unchanged. When

sparked in the presence of excess of hydrogen, the perfluoride is completely decomposed with the production of hydrogen sulphide and hydrogen fluoride; these compounds, acting on the glass of the containing vessel, form a yellow solid, which consists of sulphur, silica, and hydrofluosilicic acid. A mixture of the perfluoride and oxygen, when strongly sparked, yields a brown, flocculent solid; one part by volume of the latter gas is absorbed, and the total contraction is two volumes; when the current intensity is diminished, the reaction takes a different course, an oxyfluoride of sulphur being produced, which is less rapidly decomposed by water than thionyl fluoride.

When the perfluoride is heated with sulphur vapour in a glass vessel, lower fluorides of sulphur are produced, and these act on the glass, forming silicon fluoride and sulphur dioxide; if the heating is prolonged, the decomposition is complete. Selenium behaves in a similar manner, but the reaction is more complicated, a mixture of silicon fluoride and the dioxides of sulphur and selenium being obtained.

Calcium and magnesium, when heated in the gas, are only superficially attacked; boiling sodium, however, rapidly absorbs the perfluoride. When the gas is heated with hydrogen sulphide, the following reaction takes place: $\text{SF}_6 + 3\text{H}_2\text{S} = 6\text{HF} + 4\text{S}$; the hydrogen fluoride immediately attacks the glass of the vessel, so that hydrofluosilicic and silicic acids are the ultimate products.

The paper contains a description of the apparatus employed in preparing the mixed fluorides.

G. T. M.

Density and Analysis of Sulphur Perfluoride. By HENRI MOISSAN and PAUL LEBEAU (*Compt. rend.*, 1900, 130, 984—988).—The gaseous sulphur perfluoride (preceding abstract) has a sp. gr. 5.03 (air=1); its analysis was effected by heating it with sodium vapour, a mixture of sodium sulphide and fluoride being thus obtained, and also by heating with sulphur in glass vessels, and measuring the volume of the silicon fluoride and sulphur dioxide produced. The perfluoride was also decomposed by heating with selenium. The results thus obtained are in close agreement with the formula SF_6 .

N. L.

Sulphuric Acid containing Selenium. By CHARLES F. SCHLAG-DENHAUFFEN and C. PAGEL (*J. Pharm.*, 1900, [vi], 11, 261—262).—A large number of samples of so-called "pure" sulphuric acid were found to contain selenium; a very delicate test for the latter consists in adding a fragment of codeine to 4 or 5 drops of the concentrated acid, when a green coloration is produced in the cold, which changes to bluish-green at 100°.

W. A. D.

Passage of Argon through Thin Films of Indiarubber. By LORD RAYLEIGH (*Phil. Mag.*, 1900, [v], 49, 220—221).—Air was allowed to diffuse into an indiarubber balloon, and the composition of the contents then determined; it was found that the argon now formed 1.93 per cent. of the argon and nitrogen, whilst corresponding percentage for air itself was 1.19. Argon, therefore, passes through indiarubber more readily than nitrogen, but not in such a degree as to render the process suitable for the concentration of argon from the atmosphere.

L. M. J.

Electrolysis of Alkali Chloride Solutions with a Diaphragm. By FRITZ FOERSTER and F. JORRE (*Zeit. anorg. Chem.*, 1900, 23, 158—219).—Theoretical considerations show that the yield of chlorine obtained in the electrolysis of neutral alkali chloride solutions will in general be less than the yield of alkali, so long as the existence of hypochlorite in the anode solution is possible (compare this vol., ii, 72). When a diaphragm is used, the nature of the process depends on three factors—the ordinary electrical conduction in the diaphragm, the diffusion, and the electrical endosmose.

Experiments with a platino-iridium anode, in which the anode and cathode solutions were analysed after the electrolysis, showed that the total yield of alkali diminishes with increasing concentration of the alkali hydroxide. The yield of chlorine was found to be less than the yield of alkali, especially in the first stages of the electrolysis; the difference vanished later on when the chlorate and hydrogen chloride concentrations became appreciable. The chloride concentration, owing to the electrical endosmose, falls much more slowly in the cathode solution than in the anode solution. Analysis of the anode solution after electrolysis indicated the presence of free hypochlorous acid and alkali chlorate, but not of alkali hypochlorite. The proportion of oxygen liberated at the anode increases regularly with the progress of the electrolysis.

When carbon anodes are used, the process of electrolysis is essentially the same; the gas liberated at the anode contains carbon dioxide, and hydrogen chloride is found in the anode solution at a higher alkali chloride concentration than when platino-iridium anodes are used.

Solutions of potassium chloride give a better current yield than those of sodium chloride; this is connected partly with the greater dissociation of the former salt, and the greater velocity of migration of the potassium ion.

J. C. P.

Production of Iodated Potassium and Ammonium Carnallites. By AUGUST DE SCHULTEN (*Bull. Soc. Chim.*, 1900, [iii], 23, 158—159. Compare Abstr., 1898, ii, 512).—Substituted carnallites of the formulæ $KI, MgI_2 + 6H_2O$ and $NH_4I, MgI_2 + 6H_2O$ are obtained when solutions of the mixed salts are left to evaporate over sulphuric acid in a vacuum. The crystals form flattened prisms, are very hygroscopic, and have respectively the sp. grs. 2.547 and 2.346 at 15°. N. L.

Action of Chlorine on Metallic Silver in the Light and in the Dark. By V. VON CORDIER (*Monatsh.*, 1900, 21, 184—199).—The action of chlorine on pure silver has been tried under varying degrees of illumination, and it is found that (i) dry chlorine has no action, either in the light or in the dark; (ii) moist chlorine has a weak action, which, within certain limits, varies with the intensity of the light; (iii) illumination of the chlorinated silver in a stream of an indifferent gas causes a decrease in weight of the silver, probably due to a decomposition of the silver chloride; (iv) an intense illumination of the chlorine before contact with the silver causes an increased absorption; (v) electric sparking of the chlorine has the same effect.

Copper, treated under similar conditions to silver, gives different results. R. H. P.

Reducing Action of Calcium Carbide. By H. CHR. GEELMUYDEN (*Compt. rend.*, 1900, 130, 1026—1029).—Boric oxide reacts with calcium carbide, at the temperature of the electric furnace, to form calcium boride, CaB_2 . Under the same conditions, the sulphides of iron, lead, antimony, and magnesium are also reduced, the metals being completely volatilised, except in the case of iron. Aluminium sulphide is not reduced by calcium carbide. N. L.

Hydrated Barium Peroxides. By ROBERT DE FORCRAND (*Compt. rend.*, 1900, 130, 778—780; 834—837).—The results given in the first of these papers are incorrect, the heat of dissolution of hydrated barium hydroxide having been taken as +14.1 Cal. instead of -14.1 Cal.; the correct figures are given in the second paper. Experiments with various proportions of hydrogen peroxide and barium oxide lead to the conclusion that $\text{BaO diss.} + \text{H}_2\text{O}_2 \text{ diss.} = \text{BaO}_2 \text{ ppt.} + \text{H}_2\text{O}$ develops +25.497 Cal., whilst the dissolution of the peroxide in dilute hydrochloric acid develops +2.723 Cal. These results differ somewhat from the earlier results of Berthelot.

The barium peroxide obtained in this manner is never quite free from monoxide, but, contrary to the general belief, the proportion of peroxide is highest when the barium monoxide, and not the hydrogen peroxide, is in excess.

The conversion of the peroxide into the trioxide, and of the latter into the tetroxide, by the action of a large excess of hydrogen peroxide, seems to be accompanied by no appreciable thermal disturbance. The conversion is, as a rule, incomplete, and the composition of the product varies with the conditions. C. H. B.

Heat of Formation of Hydrated and Anhydrous Strontium Dioxide. By ROBERT DE FORCRAND (*Compt. rend.*, 1900, 130, 1017—1019).—The heat of formation of the precipitated, hydrated dioxide, $\text{SrO}_2 + 9\text{H}_2\text{O}$, obtained by mixing solutions of the monoxide and hydrogen peroxide, is 26.576 Cal., which is about 1 Cal. higher than the corresponding figure for barium dioxide (preceding abstract); its heat of dissolution in hydrochloric acid is 1.744 Cal. The heat of dissolution of the anhydrous dioxide in hydrochloric acid is 22.225 Cal., whence it is calculated that the heat of formation of the dioxide from the solid monoxide and gaseous oxygen is 10.875 Cal., whilst its heat of hydration is 20.481 Cal. (liquid water) and 7.611 Cal. (solid water). Comparison of these figures with the heat of formation (12.10 Cal.) and hydration (18.20 Cal.) of barium dioxide explains why anhydrous strontium dioxide is less stable and less easy to obtain free from monoxide than the barium compound, whereas, with the hydrated dioxides, the relative stability is reversed. N. L.

Reactions of Magnesium, Zinc, and Iron with Solution of Cupric Sulphate. By ROBERT M. CAVEN (*J. Soc. Chem. Ind.*, 1900, 19, 18—22. Compare *Proc.*, 1897, 13, 221; 1898, 14, 57).—The action of magnesium, zinc, and iron on solutions of copper sulphate is not one of simple displacement of copper by the other metal only, but

is attended with several complicated reactions, such as evolution of hydrogen, formation of cuprous oxide, basic cupric sulphate, cuprous sulphate, and even free sulphuric acid ; also of oxides, or basic sulphates of magnesium, zinc, or iron.

The experiments have been conducted with solutions of copper sulphate of varying strength and at different temperatures, and the results are tabulated.

L. DE K.

Influence of Ammonia on Magnesium Salts. By W. SCHIEBER (*Chem. Centr.*, 1900, i, 652 ; from *Oesterr. Chem. Zeit.*, 3, 83—84).—The addition of ammonia to a solution of a magnesium salt containing as much as 4 mols. of ammonium salt to 1 mol. of magnesium salt will often cause the solution to become turbid, and on boiling a precipitate is always formed. The prevention of the precipitation of magnesium hydroxide by means of ammonium salts is not only dependent on the relative quantities of the ammonium and magnesium salts present, but also on the amount of free ammonia added, and possibly also on the concentration, hence, in separating alumina from magnesia, a considerable quantity of ammonium chloride is required, but the ammonia added should be reduced to a minimum.

E. W. W.

Electrolytic Deposition of Brass. By J. LIVINGSTON R. MORGAN (*J. Amer. Chem. Soc.*, 1900, 22, 93—99).—The theory of this operation is discussed. For the deposition of brass, it is necessary (1) that the solution contain zinc and copper ions in such a proportion that $P/p : P_1/p_1 :: 30 : 70$, where P and P_1 are the electrolytic solution pressures of zinc and copper, p and p_1 the osmotic pressures of their ions in the solution ; (2) that the solution contain complex ions of zinc and copper. From solutions of their simple salts, the metals would not be deposited in the requisite proportion ; this would change the composition of the liquid, and the zinc and copper of the anode would no longer dissolve in the required ratio. Further, (3) the maximum concentration of copper ions should be as small as possible, in order that copper may be easily dissolved from the anode.

The above conditions are fulfilled by a solution of the mixed zinc and copper salts in potassium cyanide. From such a solution, containing as it does the complex ions $\text{Zn}(\text{CN})_4$ and $\text{Cu}(\text{CN})_4$, zinc and copper may be deposited in varying proportions according to the current density.

J. C. P.

Zinc Selenide and its Dimorphism. By HENRI FONZES-DIAON (*Compt. rend.*, 1900, 130, 832—834).—Zinc selenide obtained by the action of zinc chloride vapour on a mixture of nitrogen and hydrogen selenide crystallises in long, rhombohedral needles carrying, laterally, hemimorphic hexagonal prisms, or in rhombohedra with striated faces, which act strongly on polarised light. The selenide obtained by the action of hydrogen on the selenate also crystallises in long needles belonging to the hexagonal system, whereas, when prepared in the electric furnace, the crystals are optically inactive, and seem to belong to the cubic system, like the crystals obtained by Margottet by heating the amorphous selenide

in hydrogen. The dimorphism of zinc selenide is therefore established, and is analogous to that of the sulphide.

Hexagonal cadmium selenide has been prepared in a similar way.
C. H. B.

Production of Cadmium Vanadinites. By AUGUST DE SCHULTEN (*Bull. Soc. Chim.*, 1900, [iii], 23, 159—160).—*Cadmium chlorovanadinite*, $3\text{Cd}_3(\text{VO}_4)_2\text{CdCl}_2$, is obtained by heating to fusion a mixture of cadmium chloride, cadmium carbonate, and vanadium pentoxide, in the form of long, hexagonal prisms having a sp. gr. 5.264 at 15° . The crystals are readily soluble in dilute acids, and melt and decompose when heated to redness. *Cadmium bromovanadinite*, $3\text{Cd}_3(\text{VO}_4)_2\text{CdBr}_2$, obtained in a similar manner from cadmium bromide, closely resembles the chlorovanadinite; it has a sp. gr. 5.456 at 15° . The corresponding iodine compound could not be obtained in a pure state.
N. L.

Action of Hydrogen on Mercury Selenide and the Inverse Action. By H. PÉLABON (*Bull. Soc. Chim.*, 1900, [iii], 23, 211—216).—Mercury selenide is attacked by hydrogen at temperatures above 400° with the production of hydrogen selenide and mercury, the reaction being limited by the inverse action of hydrogen selenide on mercury. The proportion of hydrogen selenide found in the gaseous products of the reaction increases with the temperature and with a diminution of the initial pressure. Thus, at 540° with an initial pressure of 760 mm. equilibrium is attained when 15 per cent. of hydrogen selenide is present, whilst at 440° only 0.52 per cent. is formed. On the other hand, with initial pressures of about 380 mm. and 190 mm. at 540° , the percentages of hydrogen selenide formed become 19 and 27 respectively. These results are shown to be in accordance with thermodynamical reasoning.
N. L.

Formation of Mercuriammonium Iodide by the Regulated Action of Concentrated Ammonia on Mercuridiammonium Iodide. By MAURICE FRANÇOIS (*Compt. rend.*, 1900, 130, 1022—1024). When a solution of ammonia of sp. gr. 0.923 is added in large quantity to mercuridiammonium iodide, dimercuriammonium iodide is formed (this vol., ii, 208, 280), but if the ammonia is added slowly and in small portions at a time, mercuriammonium iodide, NH_2HgI , is obtained. The reaction is limited and reversible, since the new compound is reconverted into mercuridiammonium iodide by the action of ammonia and ammonium iodide. Mercuriammonium iodide is a white, crystalline substance, which does not redden on exposure to air and is insoluble in ether.
N. L.

Separation of Rare Earths. By G. URBAIN (*Ann. Chim. Phys.*, 1900, [vii], 19, 184—274).—A detailed account of the fractionation of the rare earths from *æschynite* and *monazite* by methods which have been previously indicated (compare Abstr., 1897, ii, 318; 1898, ii, 518; 1899, ii, 28, 424, 789).
G. T. M.

Separation of the Rare Earths. By R. CHAVASTELON (*Compt. rend.*, 1900, 130, 781—782).—On adding a neutral solution of the salts of cerium, lanthanum, didymium, and thorium to a saturated

solution of sodium sulphite, the last named element remains in solution whilst the others are precipitated as sulphites; the separation is practically complete, the thorium solution containing only traces of the other elements. The mixed sulphites are dissolved in hydrochloric acid and the trace of thorium carried down with these salts is precipitated by treating the solution of the chlorides with hydrogen peroxide; the oxides of the other metals, precipitated from the filtrate by ammonia, are suspended in a solution of an alkali hydrogen carbonate saturated with carbon dioxide, when the cerium oxide dissolves forming a brown solution, the operation being repeated with fresh quantities of the hydrogen carbonate until the residue no longer develops a brown coloration with hydrogen peroxide. The residue now consists of the double sodium carbonates of lanthanum and didymium; the cerium separates in the form of a light yellow precipitate on adding an alkali hydroxide to the brown solution or as an orange-brown precipitate on adding hydrogen peroxide. The latter precipitate dissolves in acids with evolution of carbon dioxide and when hydrochloric acid is employed chlorine is also evolved; the solutions obtained in the cold are yellow and are rendered colourless on warming; these reactions indicate that the compound is a ceric carbonate.

As an alternative method of separation, the oxides of the four elements, obtained by adding ammonia and hydrogen peroxide to solutions of their chlorides, are treated with a solution of an alkali hydrogen carbonate, the peroxides of cerium and thorium dissolve forming a brown solution and the separation of these metals may be effected by either of the following processes: (1) reduction of the peroxides and formation of the sulphites by the action of sulphurous acid and the precipitation of thorium by hydrogen peroxide from a hydrochloric acid solution of these salts; (2) reduction of the brown solution of ceric and thoracic carbonates with sulphurous acid in the presence of sufficient sodium carbonate to keep the whole of the thorium dissolved as the double sodium sulphite. In the latter process, the solution must be constantly agitated during the addition of the sulphurous acid in order to prevent the formation of acid sulphite, otherwise some of the cerium will be dissolved whilst traces of thorium will be precipitated.

G. T. M.

New Method of Fractionating some Rare Earths. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1900, 130, 1019—1022).—The method consists in the fractional crystallisation of the double nitrates of magnesium and the rare earths from nitric acid of sp. gr. 1.3. These salts have the general formula $M_2(NO_3)_6 \cdot 3Mg(NO_3)_2 + 24H_2O$, and are formed by lanthanum, cerium, and the other earths up to holmium, but not by yttrium; their solubility increases with the molecular weight.

N. L.

Austrium. By RICHARD PRIBRAM (*Monatsh.*, 1900, 21, 148—155. Compare Abstr., 1886, 773).—The orthite investigated by Linnemann (*loc. cit.*) has been re-examined by the author, who agrees with Lecoq de Boisbaudran (*Compt. rend.*, 1886, 102, 1436) that Linnemann's "austrium" is identical with gallium. However, from a minute

spectroscopic examination of the mineral, he comes to the conclusion that it contains a new element yet to be isolated. This is provisionally named *austrium*, although it is quite distinct from the element described originally by Linnemann. R. H. P.

New Hydrate of Alumina. By V. ZUNINO (*Gazzetta*, 1900, 30, i, 194—199).—When aluminium is immersed in mercury and afterwards exposed to moist air, a voluminous, greyish, spongy mass is formed on the surface of the metal; the author shows that this substance consists essentially of a *hydrated alumina*, of the composition $\text{Al}_2\text{O}_3 + 5\text{H}_2\text{O}$, small quantities of aluminium, iron, and carbon being also present. This compound is also formed by the action of amalgamated aluminium on water, large quantities of hydrogen being evolved at the same time. T. H. P.

Natural and Artificial Pozzuolana. By GIOVANNI GIORGIS and UGO ALVISI (*Gazzetta*, 1899, 29, i, 185—263, and 1900, 30, i, 96—125).—A bibliographical and historical paper, treating of the subject under the four heads: 1. Natural volcanic and non-volcanic pozzuolana. 2. Artificial pozzuolana. 3. Technical notes on pozzuolana. 4. The principal theories concerning the setting of hydraulic cements. The first three of these divisions are here considered. T. H. P.

A Crystallised Selenide and an Oxy-selenide of Manganese. By HENRI FOMES-DIAON (*Compt. rend.*, 1900, 130, 1025—1026).—Cubical crystals of manganese selenide, MnSe , are obtained by the action of hydrogen selenide on a solution of manganese acetate containing a small quantity of hydrochloric acid, by reducing manganese selenate with carbon in the electric furnace, or by fusing the precipitated selenide at a high temperature. Prismatic crystals of the same composition are produced by the action of hydrogen selenide on manganese chloride at a red heat. Crystallised manganese selenide has a sp. gr. 5.59 at 15° , is slightly acted on by water at 100° , and is readily attacked by dilute acids; treatment with hydrogen peroxide converts it into manganese selenate.

Manganese selenate is reduced by hydrogen at a bright red heat with the formation of a green oxy-selenide, analogous to the oxy-sulphide which is formed by a similar reaction. N. L.

Iron Carbonyls and their Importance in the Industrial Application of Water-Gas. By M. VAN BREUKELEVEEN and A. TER HORST (*Rec. Trav. Chim.*, 1900, 19, 27—32).—Gaseous mixtures containing carbon monoxide have a marked action on iron even under the ordinary pressure. A sample of producer gas containing 37 per cent. of the monoxide, after remaining for 1 week in contact with a polished iron surface, yields a large amount of a volatile iron compound. When the percentage of carbon monoxide is low, the action is inappreciable; a sample of coal gas containing only a small amount of this oxide remained quite free from iron carbonyl after a week's exposure to iron surfaces. The producer gas may be freed from iron carbonyl by passing it over copper heated to 300° , or over moistened potassium permanganate. G. T. M.

Constitution and Genesis of Iron Sulphates. By RUDOLF SCHARIZER (*Zeit. Kryst. Min.*, 1900, 32, 338—354).—Compare Abstr., 1899, ii, 30).—The second paper of this series deals with the action of solutions of various strengths of normal ferric sulphate on ferric hydroxide and on precipitated basic ferric sulphate. In both cases, there are obtained solutions of basic ferric sulphate, $\text{Fe}_2\text{S}_2\text{O}_8$, which is decomposed when the solution is diluted or warmed. L. J. S.

Nickelous Arsenide. By ALBERT GRANGER and GASTON DIDIER (*Compt. rend.*, 1900, 130, 914—915. Compare Abstr., 1894, ii, 392; 1896, ii, 602).—A *nickelous arsenide* having the formula Ni_2As_2 is produced by heating the finely divided metal at 600° in the vapour of arsenious chloride; the compound thus obtained forms reddish, crystalline granules having a metallic lustre and resembling the impure arsenide isolated by Wöhler from smalt residues. Although the arsenide differs in composition from the phosphide, Ni_3P , obtained under similar conditions, it resembles this compound in its chemical properties, being decomposed by heat, soluble in nitric acid and aqua regia, and readily attacked by chlorine and fused alkalis.

G. T. M.

Decomposition of Nickel Carbonyl in Solution. By VICTOR LENHER and HERMANN A. LOOS (*J. Amer. Chem. Soc.*, 1900, 22, 114—116).—By the action of moisture on solutions of nickel carbonyl in organic solvents, a green precipitate is produced similar to that furnished by the pure substance in contact with water or moist air. Berthelot (Abstr., 1892, 279) considered this product to be nickelous hydroxide free from carbon, whereas, according to Mond (*J. Soc. Chem. Ind.*, 1892, 11, 750), it is a nickel carbonate of varying composition. The present authors show that it is a decomposition product containing nickel carbonyl and nickelous hydroxide; analysis of a specimen from a toluene solution gave results which point to the composition $\text{Ni}(\text{CO})_4 \cdot 2\text{Ni}(\text{OH})_2 \cdot 4\text{H}_2\text{O}$. E. G.

Nature of the Change from Violet to Green in Solutions of Chromium Salts. By FRANCIS P. VENABLE (*J. Amer. Chem. Soc.*, 1900, 22, 111—114).—A reply to Whitney (this vol., ii, 211), in which the author accepts his results as conclusive. E. G.

Double Carbonates of Chromous Oxide; Saline Oxide of Chromium. By GEORGES BAUGE (*Ann. Chim. Phys.*, 1900, [vii], 19, 158—184).—A *résumé* of work already published. Compare Abstr., 1896, ii, 426; 1898, ii, 294, 592; 1899, ii, 157). G. T. M.

New Method for the Preparation of Double Sulphates of Chromium. By C. PAGEL (*Compt. rend.*, 1900, 130, 1030—1032).—When, as in toxicological investigations, the destruction of organic matter is effected by heating with sulphuric acid and potassium dichromate, the double sulphate, $\text{Cr}_2(\text{SO}_4)_3 \cdot 3\text{K}_2\text{SO}_4$, is produced, whilst if sodium dichromate is employed the analogous sodium salt is obtained. Both compounds crystallise in the hexagonal system, the potassium salt in green plates, and the sodium salt in green prisms. A sodium salt of the same composition, but crystallising in pale green,

slender needles is obtained by heating together sodium hydrogen sulphate, ammonium sulphate, and chromium sulphate. N. L.

Tungsten Diphosphide. By ED. DEFAQZ (*Compt. rend.*, 1900, 130, 915—917).—*Tungsten diphosphide*, WP_2 , produced by heating tungsten hexachloride at 450° in a current of hydrogen phosphide, forms a black, crystalline mass insoluble in water and the ordinary organic solvents, and having a sp. gr. 5.8. Fluorine attacks the diphosphide at temperatures above 100° , forming phosphorous and tungsten fluorides; chlorine and bromine react similarly at a red heat; when liquid chlorine is employed at 60° , a chlorophosphide is produced. Sulphur and nitrogen both displace the phosphorus from this compound at high temperatures, forming the disulphide and nitride respectively; the disulphide is also produced by the action of hydrogen sulphide on the phosphide at 500° . The diphosphide readily burns in air or oxygen, forming tungstic and phosphoric oxides, its combustion in the latter gas being attended by a very dazzling flame. A complete reduction of the phosphide is effected by heating it with copper or zinc, tungsten being liberated, and the corresponding metallic phosphide produced; the reduction by hydrogen commences at 525° , but is incomplete even at 900° .

Lead at 900° only partially reduces the diphosphide, and copper phosphide at 1400° produces another tungsten phosphide; when heated with iron, the diphosphide is converted into a double *iron tungsten phosphide*; with aluminium, the reaction is even more complicated, and the product contains a large amount of silicon derived from the crucible. Hydrofluoric and hydrochloric acids do not act on the diphosphide, but a mixture of the former with nitric acid dissolves this compound even in the cold, whilst aqua regia decomposes it on warming; sulphuric and nitric acids, when heated, are reduced by the phosphide, sulphurous acid and blue tungsten oxide being formed in the first case, and nitrous and tungstic acids in the second. The diphosphide is dissolved by fused caustic alkalis and potassium hydrogen sulphate, and is even more readily attacked by heated mixtures of alkali nitrates and carbonates. G. T. M.

Paratungstates. By L. A. HALLOPEAU (*Ann. Chim. Phys.*, 1900, [vii], 19, 92—144).—A *résumé* of work already published (compare Abstr., 1895, ii, 503; 1896, ii, 607; 1897, ii, 178, 498; 1898, ii, 540; 1899, ii, 32, 158, 159, 555). G. T. M.

Actinium: A New Radio-active Element. By A. DEBIERNE (*Compt. rend.*, 1900, 130, 906—908).—The new radio-active element, *actinium*, belonging to the iron group (compare this vol., ii, 20), may be obtained in a more concentrated form by submitting the substances containing it to the following operations: (1) Addition of excess of sodium thiosulphate to solutions slightly acidified with hydrochloric acid; (2) action of hydrofluoric acid and potassium fluoride on the freshly precipitated hydroxides suspended in water; (3) oxidation of neutral solutions of the nitrates by hydrogen peroxide; (4) precipitation of insoluble sulphates. In every case, the precipitate or residue is strongly radio-active, and contains nearly the whole of the actinium;

the second process serves to separate this substance from titanium. The element itself has not been isolated from these mixtures, and in all probability the above reactions are not peculiar to actinium, the radio-active substance being precipitated along with other insoluble compounds, just as ferric oxide is carried down by barium sulphate. By a methodical application of these processes, however, the greater portion of the new element may be extracted from pitchblende.

Chemical and spectroscopic examination of the most active fractions indicates that the predominant element is thorium. Unlike radium or polonium, the new element is not affected by the precipitants for barium or bismuth.

The rays emitted by actinium produce the same effects as those from radium and polonium; a portion of the rays is deflected in a strong magnetic field, the deviation being in the same sense as that of the radium and cathode rays; actinium induces permanent radio-activity on substances placed in its vicinity; its inductive action is, however, very feeble.

Actinium seems to resemble thorium in its chemical properties, and the slight radio-activity exhibited by compounds of the latter may possibly be due to the presence of the former substance. G. T. M.

Thorium Salts. By ARTHUR ROSENHEIM and JOHANNES SCHILLING (*Ber.*, 1900, 33, 977—980).—When thorium hydroxide is washed with alcohol, dissolved in alcoholic hydrogen chloride, and evaporated under diminished pressure, the *hydroxychloride*, $\text{ThCl}_2(\text{OH})_2 + 8\text{H}_2\text{O}$, crystallises in slender, white, hygroscopic needles. The mother liquor from these yields the normal *chloride*, $\text{ThCl}_4 + 9\text{H}_2\text{O}$, which forms well developed crystals and slowly deliquesces. A *hydroxychloride* of the formula $\text{OH} \cdot \text{ThCl}_3 + 11\text{H}_2\text{O}$ is obtained when the solution of the hydroxide in alcoholic hydrogen chloride is evaporated almost to dryness, and the residue treated with aqueous hydrochloric acid. It has been found impossible to obtain the compound of thorium chloride with hydrogen chloride, H_2ThCl_6 , in the free state, but a stable pyridine salt of this acid has been prepared, $(\text{C}_5\text{H}_5\text{N})_2\text{H}_2\text{ThCl}_6$, which forms a compact, crystalline crust.

Thorium hydroxybromide, $\text{ThBr}_2(\text{OH})_2 + 11\text{H}_2\text{O}$, forms small, quadratic crystals, whilst the *bromide*, $\text{ThBr}_4 + 7\text{H}_2\text{O}$, crystallises in well-developed needles. *Pyridine thoribromide*, $(\text{C}_5\text{H}_5\text{N})_2\text{H}_2\text{ThBr}_6$, closely resembles the corresponding chloride, but soon decomposes with evolution of hydrogen bromide.

Chlorides of thorium containing $8\text{H}_2\text{O}$ and $7\text{H}_2\text{O}$, and bromides containing $8\text{H}_2\text{O}$ and $10\text{H}_2\text{O}$ have been described previously. A. H.

A Radio-active Substance Emitted from Thorium Compounds. By E. RUTHERFORD (*Phil. Mag.*, 1900, [v], 49, 1—14).—Schmidt has shown that thorium emits radiations analogous to those emitted by uranium (*Abstr.*, 1898, ii, 550). The author finds that when the radiations proceed from thin layers of thorium oxide, they may be almost completely cut off by a few sheets of paper; but if thick layers of thorium oxide are employed, the radiations are but slightly affected, even by many layers of paper, and further, that the inconstancy of the intensity of the radiations is due to air currents.

The author considers that the radio-activity is due to two causes, (1) radiations, and (2) an emanation which passes away from the oxide, and is capable of passing through paper or metals in thin sheets, but is stopped by mica. This emanation may be carried away by air currents, and the intensity of the radio-activity *slowly* falls, being reduced to about one-half its value in one minute; it passes through cotton-wool without loss of its activity, and may be bubbled through hot or cold water or sulphuric acid; in this respect, it differs from ions. It can affect photographic plates, causes ionisation of gases, and does not appear to be affected by the nature of the surrounding gas. The nature of the emanation is doubtful, as it does not appear to consist of fine dust particles, whilst if a vapour it is insufficient to cause any change in the spectrum of a Plücker vacuum tube. L. M. J.

Radio-activity produced in Substances by the Action of Thorium Compounds. By E. RUTHERFORD (*Phil. Mag.*, 1900, [v], 49, 161—192).—Thorium compounds, especially the oxide, not only possess the property of emitting radiations, but also produce radio-activity in substances placed near them, and in an electric field the radio-activity is chiefly produced, and may be concentrated, upon negatively electrified bodies. This radio-activity is most probably due, not to the radiations from thorium, but to the 'emanation' (preceding abstract), as both emanation and the power of producing radio-activity are removed by air currents and destroyed by high temperatures, whilst further, the intensity of the excited radio-activity is found to be proportional to the current due to the emanation. The radio-activity is independent of the nature of the substance upon which it is produced, metals, wood, and paper being equally affected, and appears to be a surface effect; its intensity falls very slowly, being reduced to about one-half in 11 hours after removal from the influence of the thorium. It decreases with the pressure at low pressures, but is practically constant above about 16 mm., and varies little with the nature of the gas. No dust could be observed to be deposited on excited wires when microscopically examined, neither was any increase of weight found; the activity is not destroyed by heating, but may be removed by long scouring with emery cloth. It is rapidly destroyed by hydrochloric or sulphuric acid, but is only slowly removed by hot or cold nitric acid or sodium hydroxide, and still remained after the electric deposition of a film of copper on the wire. Further, when destroyed by hydrochloric or sulphuric acid, the residue from the acid after evaporation is strongly radio-active. The question as to whether this activity is due to the deposition of positive ions or to that of radio-active particles of the emanation is shortly discussed, although neither view is completely satisfactory (see also Curie, this vol., ii, 126).

L. M. J. :

Action of Hydrogen on Antimony Sulphide. By H. PÉLABON (*Compt. rend.*, 1900, 130, 911—914).—The paper deals with the study of the balanced reaction $\text{Sb}_2\text{S}_3 + 3\text{H}_2 = 3\text{H}_2\text{S} + 2\text{Sb}$ at temperatures above 360° , the reagents being contained in sealed tubes. When the temperature is below the melting point of the sulphide, the product consists of a mixture of two solids in contact with a gaseous mixture,

and from the laws of chemical statics the final composition of the gas should be independent of the pressure and of the mass of the solids, and should depend only on the temperature. In order to verify this conclusion, varying quantities of stibnite were heated with hydrogen for 30 hours at constant temperatures; the tubes were then rapidly cooled, the gas analysed, and the results expressed in terms of the partial pressure of hydrogen sulphide in the gaseous mixture. The weight of stibnite and the initial pressure of the hydrogen were varied considerably, but at 440° the partial pressure was practically the same in every case, the extreme values being 42.98 and 43.6; this result was not affected by the preliminary addition of varying amounts of antimony, the mean of four experiments being 43.29. When the temperature is above the melting point of antimony sulphide, this compound dissolves the liberated antimony, so that in this case the equilibrium is established between two homogeneous systems. The final composition of the gas should now depend on the concentration of the solution of antimony in antimony sulphide, and therefore on the amount of stibnite originally present. The experimental results entirely justify this conclusion; at 610° , the amount of hydrogen sulphide increases as the weight of stibnite employed diminishes.

If an excess of antimony is present, the solution of the metal in its sulphide is always saturated, and in this particular case, providing that all the sulphide is not decomposed, the amount of hydrogen sulphide produced should depend solely on the temperature; in accordance with this generalisation, it is found that the factor determined increases with the temperature, being 48.6 at 510° and 56.92 at 625° . When hydrogen sulphide is left in contact with antimony in sealed tubes at constant temperatures, a certain amount of the gas is decomposed, and if the temperature is below the melting point of the metal, the limiting value of the partial pressure is identical with the factor obtained by treating stibnite with hydrogen at the same temperature. If, however, the antimony has melted, the value obtained for the partial pressure is lower than that observed in the inverse reaction; the discrepancy is probably due to the solution of the sulphide in the fused metal.

When the four substances are all present in the system studied, the value of the factor increases with the temperature, and supposing that, as at 15° , the direct reaction is accompanied by an absorption of heat, the experimental results are in complete agreement with the law relating to the variations of chemical equilibrium produced by changes of temperature.

G. T. M.

Crystallised Bismuth Salts. By AUGUST DE SCHULTEN (*Bull. Soc. Chim.*, 1900, [iii], 23, 156—158).—Three grams of bismuth oxide are dissolved in 300 c.c. of hydrochloric acid of sp. gr. 1.05, and the solution mixed with 2.5 litres of boiling water, filtered, and left to cool, when bismuth oxychloride, BiOCl , separates in colourless, quadratic crystals of sp. gr. 7.717 at 15° ; the crystals are negative and uniaxial. Bismuth oxybromide and oxyiodide are prepared in an analogous manner, and resemble the oxychloride in their crystallographic

and optical properties. The oxybromide is colourless and has a sp. gr. 8.082 at 15°, whilst the oxyiodide is of a coppery tint and has a sp. gr. 7.922. N. L.

Mineralogical Chemistry.

Coals, Bitumen, &c., from the Silurian of Bohemia. By C. FRIEDRICH EICHLER (Chem. Centr., 1900, i, 624—625; from *Verh. k.k. geol. Reichsanst. Wien*, 1899, 348—362).—Several analyses are given of coals and bituminous substances from fossiliferous strata.

L. J. S.

Cerussite from the Altai. By PAVEL V. VON JEREMÉEFF (*Zeit. Kryst. Min.*, 1900, 32, 429; from *Verh. k. russ. min. Ges.*, 1899, 36, Protok., 12—15).—Twin crystals of cerussite from the Sirjanowsk mine gave, on analysis by J. A. Antipoff.

PbO.	CO ₂ .	SO ₂ .	ZnO.	CdO.	Fe ₂ O ₃ .	Al ₂ O ₃ .	H ₂ O.	Insol.	Total.
77.63	14.12	2.07	0.51	0.15	6.63	1.42	1.24	1.38	99.15

This corresponds with 87.60 per cent. PbCO₃; the iron and aluminium belong to the gangue. A crystallographic description is given.

L. J. S.

Pseudomorphs after Olivine from the Urals. By PAVEL V. VON JEREMÉEFF (*Zeit. Kryst. Min.*, 1900, 32, 430; from *Verh. k. russ. min. Ges.*, 1899, 36, Protok., 24—27).—Various pseudomorphs after olivine from different localities in the Schischimsk and Nasjansk mountains, Urals, are described. The following analysis by Nikoléeff of the least altered crystals show them to be monticellite.

SiO ₂ .	Al ₂ O ₃ .	FeO.	CaO.	MgO.	Mn.	Loss on ignition.	Total.
36.44	0.62	2.80	32.11	25.35	trace.	1.68	99.00

The various stages in the process of alteration are suggested to be: the alteration of the olivine to serpentine, then, by the action of a solution containing an aluminosilicate, to epidote, and finally the partial alteration of the epidote to steatite and clay. L. J. S.

Composition of Plagioclase. By W. TARASSENKO (*Zeit. Kryst. Min.*, 1900, 32, 423; from *Tagebuch X. Vers. russ. Naturf. Aertze in Kiew*, 1898, No. 10, 379—380).—Labradorite from Selistsche, Gov. Wolinsk, was powdered and separated by a heavy liquid into six portions of sp. gr. (1) lighter than 2.647 (0.5 gram); (2) 2.647—2.669 (1.1 grams); (3) 2.669—2.675 (9 grams); (4) 2.675—2.680 (11 grams); (5) 2.680—2.710 (2.9 grams); (6) heavier than 2.710 (0.07 gram).

The four portions (2)—(5) gave on analysis the maximum and minimum results under I and II respectively.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃ , TiO ₂	CaO.	Na ₂ O.	K ₂ O.	Loss at 120°.	Loss on ignition.
I.	55.33	28.44	0.42	10.32	5.37	1.26	0.11	0.36
II.	55.09	28.02	0.30	10.01	5.04	0.98	0.04	0.33

This is considered to prove that the plagioclases are not isomorphous mixtures, but compounds of the albite and anorthite molecules in definite proportions.

L. J. S.

Two New American Meteorites. By H. L. PRESTON (*Amer. J. Sci.*, 1900, [iv], 9, 283—286).—*Luis Lopez, New Mexico.*—This iron, which weighs 6903 grams, was found in 1896 near Luis Lopez, Socorro Co. It contains numerous nodules of troilite surrounded by zones of schreibersite or of a graphitic substance. The etched surface shows typical octahedral Widmanstätten figures. The structure and chemical composition (anal. I by Mariner and Hoskins) of this iron distinguish it from the five other irons (Costilla, Glorieta, El Capitan, Sacramento Mts., and Oscuro) recently found in this portion of New Mexico.

	Fe.	Ni.	Co.	Si.	P.	S.	C.	Total.	Sp. gr.
I.	91.312	8.170	0.160	trace	0.338	0.013	0.012	100.000	7.7
II.	94.734	4.620	0.180	—	0.442	0.015	0.009	100.000	7.5

Central Missouri.—All that is known of the history of this iron is that it was found in the fifties in Central Missouri. About half the mass weighs 12360 grams. It is penetrated by numerous fissures filled with a graphite-like substance, and in part by schreibersite. The etched surface is minutely pitted. Analysis by Mariner and Hoskins gave the results under II.

L. J. S.

Water from Jouhe, near Dôle (Jura). By PAUL BOURCET (*Bull. Soc. Chim.*, 1900, [iii], 23, 144—145; *J. Pharm.*, 1900, [vi], 11, 223—224).—This water is only very slightly mineralised, the principal constituents being sodium and magnesium chlorides and calcium sulphate and hydrogen carbonate, whilst, contrary to the local opinion, it contains only a trace of dissolved hydrogen sulphide; the reputation for therapeutic power that it holds does not thus appear to be justified.

W. A. D.

Physiological Chemistry.

Relative Digestibility of Certain Fats in the Human Intestine. IV. Lard Substitute ("Kunstspeisefett"). By H. LÜHRIG (*Zeit. Nahr. Genussm.*, 1900, 3, 73—87).—Comparative experiments with genuine lard, and with two mixtures of fats sent into commerce as cheap lard-substitutes, of which the first consists of two parts of tallow and three parts of cotton-seed oil, and the second of

equal parts of the first and lard, show that the coefficient of digestibility of the three preparations is identical. As in former work on the digestibility of margarine (this vol., ii, 224) lecithin and unsaponifiable substances were allowed for. The analytical constants of the fats extracted from the faeces differed widely from those of the fats consumed, and there was no means of knowing whether these fats were secretions from the walls of the intestine, or consisted of unabsorbed residues of the alimentary fats. M. J. S.

The Proteid-sparing Action of Alcohol. By RUDOLF ROSEMAN (Pflüger's Archiv, 1900, 79, 461—483. Compare this vol., ii, 92).—Polemical. The author maintains his original contention and directs his criticisms against Offer (Wiener klin. Woch., 12, No. 41), who has disagreed with him. W. D. H.

Parachymosin. By IVAR BANG (Pflüger's Archiv, 1900, 79, 425—441).—Rennet ferment is destroyed by long digestion with pepsin-hydrochloric acid. Some differences in the details of the time relations of this destruction suggested that in different rennet preparations there were differences in the ferment itself. Further investigation was considered to prove that there are at least two rennet ferments; one, the ordinary rennet of the calf's stomach, termed here *chymosin*, and the other, found hitherto in preparations from the stomach of pigs and men, termed *parachymosin*. The differences between the two ferments are (1) on dilution with water the proportional loss of ferment activity gives a different curve in the two cases; (2) the hastening action of calcium chloride on their activity is quantitatively different; (3) chymosin is destroyed at 70°, parachymosin at 75°; (4) chymosin is more resistant to alkali than parachymosin. W. D. H.

Animal Juices and Tissues from the Physico-chemical Standpoint. II. Influence of the Blood Corpuscles on the Electrical Conductivity of Blood. Effect of Suspended Particles generally on Conductivity. By MAX OKER-BLOM (Pflüger's Archiv, 1900, 79, 510—533. Compare Abstr., 1900, ii, 290).—The electrical conductivity of a solution is mechanically diminished by suspended non-conducting particles, the extent of the diminution depending on the quantity and distribution of the particles, but being independent of their size (within certain limits), as well as of the absolute conductivity of the solution. The blood may be regarded as an electrolyte in which the corpuscles play the part of suspended non-conducting particles. For a given concentration of corpuscles, the ratio between the conductivity of the serum and that of the blood is constant, and independent both of the absolute conductivity of the serum and of the size of the individual corpuscles. J. C. P.

Specific Heat of Blood. By H. BORDIER (Compt. rend., 1900, 130, 799—800).—The values of the specific heats of arterial and venous blood, given by Landois in his *Traité de Physiologie*, are respectively 1.031 and 0.892, and the author, doubting the correctness of these values, has made fresh determinations, employing the method of cooling. Blood from the ox, calf, and dog, arterial and defibrinated,

as well as blood serum and venous blood, were examined, and the means of the results are: arterial blood, 0.906; venous blood, 0.893. The mean specific heat of the whole body is probably between 0.7 and 0.8.

BERTHELOT, in a footnote to the above paper, draws attention to the fact that the author has overlooked a paper (Abstr., 1890, 274) in which he showed that the specific heat varies notably with physiological conditions, and in which he recorded many determinations of the values.
L. M. J.

Oxygen in Human Blood. By A. LOEWY (*Chem. Centr.*, 1900, i, 49; from *Centr. Physiol.*, 13, 449—453).—From investigations on the influence of lessened oxygen supply on metabolism in man, the conclusion is drawn that the process can take a normal course, even when the oxygen tension is extremely low (35, or even 30 mm.). If the alveolar oxygen tension sinks below this, 'tissue dyspnoea' sets in, because, owing to the dissociation of oxyhæmoglobin, the supply of oxygen is insufficient. New work has led to some numerical results which differ from those of Hüfner (*Arch. Anat. Physiol.*, 1890); with oxygen tension of 36—37 mm. of mercury, the oxygen saturation of hæmoglobin is 80 per cent.; at 22—23 mm. mercury, it is 58.25 per cent. Hüfner worked with crystallised hæmoglobin, the present author with fresh blood. Possibly oxygen is more firmly held in the former than in the latter case.
W. D. H.

The Sense of Smell and the most important Perfumes. By ERNST ERDMANN (*Zeit. angew. Chem.*, 1900, 103—116).—The paper, which is of a popular character, contains a list of the more important substances used as perfumes, classified as (1) aldehydes, (2) alcohols and esters, (3) ketones, (4) phenols and phenyl ethers, (5) acids and acid anhydrides, (6) nitrogenous substances, (7) hydrocarbons.

C. F. B.

Different Effect of Ions on Animal Tissues. By JACQUES LOEB (*Amer. J. Physiol.*, 1900, 3, 383—396).—A controversy exists as to whether in the heart, and also in such animals as jelly fish, the contractions are of muscular or nervous origin. In *Gonionemus*, the medusa selected for experiment, it appears certain that ordinarily—that is, in the presence of the potassium and calcium salts of the sea-water—the impulses start in the margin, and, therefore, probably in the nervous system. Above all, it is the chemical, not the histological, structure of ganglia which is important. The central portions of the medusa beat rhythmically in pure solutions of sodium chloride or bromide. Curarised skeletal muscles do the same, provided potassium and calcium are absent. The calcium, &c., is not the stimulus for rhythmical contractions in the heart and other tissues, but the sodium, calcium, and potassium must exist in definite proportions in the tissue itself. Thus, if the amount of sodium is too small, an increase produced by placing the tissue in a pure sodium chloride solution will initiate rhythm. If the amount of calcium is too small, an increase of it will start rhythmical contractions. Thus, skeletal muscle may be made to beat by increasing the amount of sodium, or by decreasing that of calcium by precipitation.

Potassium annihilates muscular activity rapidly, but ciliary action and cell division, which are considered generally to be protoplasmic actions of the same order, continue in the presence of enormous quantities of potassium salts. The riddle of contractility is therefore still unsolved if the contractile processes are the same in all these cases. The most important combination for the furtherance of various vital processes is a mixture of $5/8 N$ potassium chloride and a small amount of $10/8 N$ calcium chloride. In such a solution, the development of ova progresses well. That sodium salts are absent suggests that the main importance of the metals lies in the influence they have on the physical properties of protoplasm; thus, magnesium chloride will often serve as a substitute for the potassium chloride in the above mixture. The arguments in the paper are based on the theory of ionic dissociation of salts in solution. W. D. H.

Chemistry and Physiology of the Thyroid. By AD. OSWALD (*Pflüger's Archiv*, 1900, 79, 450—460. Compare Abstr., 1899, ii, 439).—Polemical. Criticism is directed against Blum's conclusions. W. D. H.

Elimination of Mercury by Patients treated with this Metal. By FRIEDRICH ESCHBAUM (*Chem. Centr.*, 1900, i, 628; from *Deut. med. Woch.*, 26, 52—55).—See this vol., ii, 368.

[Elimination of] Carbohydrates [in Urine]. By G. ROSENFELD (*Chem. Centr.*, 1900, i, 657—658; from *Centr. inn. Med.*, 21, 177—189).—The alcohols dulcitol, mannitol, and sorbitol resemble their respective carbohydrates, galactose, mannose, and dextrose, in regard to their capability of being eliminated in urine, and in this respect follow in the order given, the position of the first two, however, being still doubtful. Mannitol and dulcitol contribute little if anything to the formation of glycogen. Disregarding the possibility that the carbohydrates are converted into glycogen before being oxidised, then considerable quantities of these substances should occur in urine, and in fact 40 per cent. of the mannitol and 60 of the dulcitol ingested were found in human urine. These alcohols thus behave like dextrose in cases of diabetes. Pentacetyl galactose, when administered in large doses, is more easily oxidised than galactose, and also passes into the urine more readily without partaking in the production of glycogen. In this case, the pentacetyl galactose may possibly undergo an abnormal decomposition and not yield acetic acid and galactose. E. W. W.

Pharmacology of Chloretone [Acetonechloroform]. By T. B. ALDRICH and E. M. HOUGHTON (*Proc. Amer. Physiol. Soc.*, Dec., 1899; *Amer. J. Physiol.*, 1900, 3, xxvi—xxvii).—Acetonechloroform is regarded as an ideal anæsthetic for experimental purposes. The bodily functions are but little affected, and even after hypnosis lasting for days the animal recovers completely. Its action on the central nervous system is like that of other anæsthetics of the fatty series, although it differs in not depressing the circulatory system. The application of the drug to the exposed frog's heart produces slowing, but more complete contraction, much as digitalis does. It is a powerful germicide. It can be recovered from the brain substance, and although volatile

it is not eliminated from the lungs. The chlorides of the urine are increased, and small quantities of chloretone appear there also. As a surgical dressing it is satisfactory, wounds healing by first intention. Cilia and spermatozoa remain active for hours in a saturated aqueous solution.

W. D. H.

Physiological Action of Formaldehyde. By GIUSEPPE BRUNI (*Chem. Centr.*, 1900, i, 51—52; from *Ann. Farm. Chim.*, 1899, 324—345).—Formaldehyde of completely neutral reaction can be borne better than the acid commercial material by the animal organism. Administered internally, even in dilute solutions, formaldehyde causes vomiting. In a few days, with non-poisonous doses, there is hardening of the tissues. The acid solution is much more fatal to micro-organisms than the neutral. The antiseptic properties of formaldehyde are far greater than those of boric acid.

W. D. H.

[Physiological Action of] Mercury Derivatives of Aromatic Amines. By ALBERICO BENEDICENTI and ORESTE POLLEDRO (*Atti. Real. Accad. Torino*, 1900, 35, 297—318).—A series of experiments has been carried out on the toxicological action of *p*-mercuriodiphenylene-tetraethylmercuridiammonium acetate, called shortly diethyline.

Diethyline facilitates the precipitation of albumin and the coagulation of blood serum; it also hinders the putrefaction of these substances, its action in this respect resembling that of calomel. Like calomel, too, diethyline does not entirely stop the fermentative processes brought about by ptyalin and pepsin, which are, however, rendered less active; it does not impede the digestive processes of the stomach juices, but prevents putrefaction, the same action being exercised also in the intestines of the living animal. The only lower animals subjected to the action of diethyline were earthworms, which died much more quickly when immersed in a solution of the substance in olive oil than when in the pure oil; when given with food, diethyline probably acts as a vermifuge in the intestines, as in the faeces of rabbits to which it was administered numbers of small dead worms were always found.

On the vertebrates, diethyline has a slow cumulative poisoning action similar to that of other mercurial preparations; after death, the intestine shows hyperæmia, although much less intense than in acute poisoning, the liver being of a dark colour and the kidneys exhibiting small hæmorrhages. The pressure of the blood is diminished and the pulse slackened, whilst the urine shows the presence of mercury and an optically active sugar, but not of albumin.

T. H. P.

Chemistry of Vegetable Physiology and Agriculture.

Bacteria which Destroy Nitrates. By ALBERT STUTZER and R. HARTLEB (*Bied. Centr.*, 1900, 29, 126—128; from *Mitt. landw. Inst. Breslau*, 1900, Heft i, 108).—Hexoses and pentoses, like salts of

organic acids, can serve as sources of food and energy for bacteria which destroy nitrates. The non-denitrifying bacteria hitherto employed did not permanently hinder denitrification, and it is improbable that microbes exist which check the activity of those which destroy nitrates, so long as these have assimilable organic matter at their disposal under conditions of limited aëration.

It is suggested that stable manure should receive layers of calcareous material to neutralise the organic acids which act unfavourably on the bacteria present in the manure, in order, as quickly as possible, to get rid of the carbonaceous substances which are utilised by denitrifying microbes. Loss of ammonia may be hindered by covering the calcareous layers with soil or peat litter. N. H. J. M.

Denitrification and Decomposition of Animal Matters in Soil. By CASIMIR ROGÓYSKI (*Ann. agron.*, 1900, 26, 121—140).—Soil (233 or 200 grams), both alone and with addition of sodium nitrate, horse-dung, and urine, singly and in different mixtures, was kept for different periods of several weeks in funnels under glass shades, with provision for aëration and for absorbing any ammonia which might be evolved. At the commencement and at the conclusion of the experiments, the amounts of nitrogen in different forms was determined.

The conclusion is drawn that when denitrification takes place in presence of abundance of dung, the nitric nitrogen may, according to the conditions, be eliminated in the free state, or else it may be partly or wholly transformed into insoluble nitrogenous compounds.

When urine or ammonium salts are applied to soil along with much dung or straw, the nitrogen of the urine may be liberated in the free state, or converted into an insoluble state. The insoluble substances thus produced seem to undergo nitrification readily.

The above conclusions only hold good when dung is employed in much greater amounts than occurs in practice. With amounts of dung less excessive (but still in excess of the amounts ordinarily employed), nitrates remain unchanged in the soil, and urine is nitrified. The practical conclusions drawn from the results of the German experiments on denitrification are therefore not justified (compare Dehérain, *Abstr.*, 1898, ii, 630, and 1899, ii, 800; and Warington, *ibid.*, ii, 800). N. H. J. M.

Importance of Bacteria for the Development of Plants. By JULIUS STOKLASA (*Zeit. Zuckerind. Böhm.*, 1900, 24, 222—227).—*Brassica oleracea* was grown in enclosed vessels containing sterilised loamy sand (16 kilos.) manured with minerals and nitrate. One vessel remained sterilised in each experiment, whilst the other was inoculated with a mixture of the following soil-bacteria: *Bacillus mycoides*, *B. fluorescens liquefaciens*, *B. proteus vulgaris*, *B. subtilis*, *B. butyricus* Hueppe, *B. megatherium*, *B. uræ*, *B. mesentericus vulgatus*, and *B. coli commune*. The inoculated vessels received 5 grams of dextrose. At the conclusion of the experiment, it was found that the sterilisation of the vessels which had not been inoculated had been maintained. In the second experiment, the seed sown in the two vessels was obtained

from the corresponding plants of the first experiment. The following amounts of dry produce were obtained :

	I.		II.		III.	
	Stems, &c.	Seed.	Stems, &c.	Seed.	Stems, &c.	Seed.
Sterilised ...	11.65	1.63	8.84	0.72	9.00	0.33
Inoculated...	15.34	3.06	13.9	2.67	12.8	2.62

The results show that in absence of micro-organisms vegetation is abnormal, and that incompletely developed seed is produced.

N. H. J. M.

Influence of Light on the Respiration of Lower Fungi. By R. KOLKOWITZ (*Bied. Centr.*, 1900, 29, 121—122; from *Jahrb. wiss. Bot.*, 33, 37).—In constructing a respiration apparatus, the Pettenkofer method was adopted with some modification. Compressed air free from carbon dioxide, contained in a steel cylinder, is passed over the object of the experiment, the carbon dioxide evolved being absorbed by baryta. Electric light was employed, and electricity was also employed for heating.

It was found that light increased the respiration of *Aspergillus niger*, *Penicillium*, *Micrococcus prodigiosus*, *Proteus vulg.*, *Oidium lactis*, and *Mucor spec.* to the extent of about 10 per cent.

Different investigators have obtained very divergent results, and it is thought to be necessary that the experiments should be greatly extended.

N. H. J. M.

Production of Sucrose from Dextrose in the Cell. By J. GRÜSS (*Bied. Centr.*, 1900, 29, 136; from *Ber. deut. bot. Ges.*, 1898, 16, 17—20; and *Bot. Centr.*, 1898, 75, 15).—In experiments with barley embryos from seeds kept for 12—18 hours in water, it was found that sucrose can be formed from dextrose in the cells, and that starch and cellulose can be produced from sucrose. No aldehyde group in the sucrose molecule becomes free in the production of starch and cellulose.

N. H. J. M.

Influence of Nitrogen on the Growth of Roots. By HERMANN MÜLLER-THURGAU (*Bied. Centr.*, 1900, 29, 101—103; from *Jahresber. Wädenswil.*, 6, 45).—Water-culture experiments were made with various plants, in which portions of the roots were kept immersed in nutritive solutions containing mineral food and nitrate, the rest being in similar solutions, but without nitrate.

It was found that root development was greatest in presence of nitrate, that the roots were then more branched, and that they were richer in proteids than those which were not directly fed with nitrate.

The conclusion is drawn that roots are able to produce proteids when sugar is supplied from the leaves.

N. H. J. M.

Metamorphoses and Migrations of Compounds of the Linalool Group in Plants. By EUGÈNE CHARABOT (*Bull. Soc. Chim.*, 1900, [iii], 23, 189—191).—General remarks on the results described in previous papers by the author (*Abstr.*, 1899, i, 620, 711; this

vol., i, 241; ii, 101). The changes undergone by linalool and its derivatives during development are well shown in the essential oils obtained from the leaves, flowers, and fruit of the orange (*Citrus bigaradia*). The oil from the leaves contains about 60 per cent. of acetates of linalool and geraniol, and 20—25 per cent. of the free alcohols, whilst the proportion of limonene is small, but increases as growth proceeds. In the flowering stage, the amount of limonene is considerably increased, whilst the esters and total alcohols have fallen to 15 and 50 per cent. respectively. When localised in the rind of the fruit, the proportion of limonene in the oil is still greater, but the alcohols have almost completely disappeared, the linalool having been converted into limonene and the geraniol into citral. N. L.

Influence of Active Vegetative Growth on the Formation of Thujone and Thujol. By EUGÈNE CHARABOT (*Compt. rend.*, 1900, 130, 923—926. Compare Abstr., 1899, i, 441, 620, 711, and this vol., i, 241, and ii, 101).—The author's researches on the transformation of the terpenoid constituents of the essential oils during the growth of essence yielding plants, indicate that the changes take place in two distinct stages corresponding with the principal phases of the growth of the organism. The elaboration of the alcohols and their conversion, by the elimination of water, into esters, ethers, and terpenes occurs in the green parts of the plant and corresponds with the period of active assimilation.

The second stage of the transformation involves the oxidation of the primary and secondary alcohols into aldehydes and ketones respectively, and this corresponds with that phase in the life of the plant when the respiratory function predominates over the assimilative energy.

An examination of two samples of the essential oil of *Artemisia Absinthium* indicates that, during a period of slow growth, the amount of thujol (tanacetyllic) alcohol oxidised to thujone (tanacetone) is comparatively large, but that after a period of rapid assimilation the formation of the ketone does not keep pace with the elaboration of the alcohol. G. T. M.

Pure Culture of a Green Alga. Formation of Chlorophyll in the Dark. By MAXIME RADAIS (*Compt. rend.*, 1900, 130, 793—796).—The author, having succeeded in isolating the unicellular green alga *Chlorella vulgaris* of Beyerinck, cultivated specimens of the plant in total darkness in media rich in proteid matter and carbohydrate; under these conditions, the organism passes through an etiolated stage and then develops chlorophyll; when grown in the presence of light, the development proceeds in a similar manner, only the etiolated phase is shorter. Spectroscopic examination of the alcoholic and carbon disulphide extracts of the cells cultivated in the dark confirms the presence of chlorophyll and shows that it is identical with the colouring matter obtained from the plant when grown under ordinary conditions; the amount of chlorophyll produced is approximately the same in both cases. G. T. M.

Oil of Carthamus Tinctorius (Safflower Oil). By HENRY R. LE SUEUR (*J. Soc. Chem. Ind.*, 1900, 19, 104—106).—The following are

the means obtained in the determination of the constants of safflower oils: sp. gr. at 15.5°, 0.9267; saponification value, 189.83; acid figure, 6.14; iodine number, 141.29; Reichert-Meissl number, *nil*; insoluble fatty acids, 95.3; acetyl number, 16.1. Roughly speaking, the oil consists of 90 per cent. of glycerides of unsaturated acids and 10 per cent. of glycerides of saturated acids. The acids identified were stearic, palmitic, oleic, and linoleic, the last-named forming the larger portion of the oil. The oil has very good drying properties.

L. DE K.

Toxic Action of Compounds of the Alkaline-earth Metals towards the Higher Plants. By HENRI COUPIN (*Compt. rend.*, 1900, 130, 791—793).—A study of the action of calcium, strontium, and barium salts on young wheat plants shows that with soluble homologous compounds the toxic effect increases with the atomic weight; the insoluble salts of these metals are all innocuous. The soluble salts of calcium and strontium have a marked toxic action on plants, and their iodides are very poisonous; the soluble barium salts are all very injurious to plant life, the action being most intense in the case of the chlorate and iodide. The toxic equivalents of these compounds are arranged in tabular form.

G. T. M.

Assimilation by Plants in Soils containing different Amounts of Sand. By EMANUEL GROSS (*Bied. Centr.*, 1899, 29, 73—74; from *Fühling's landw. Zeit.*, 1899, 291).—Pot experiments are described in which barley and white mustard were grown in soil, and in the same soil (100 parts) mixed with 33, 100, and 300 parts of sand. No manure was added. In both cases, the yield and the amounts of nutritive constituents assimilated diminished, but this diminution was not in relation to increasing dilution of the soil with sand. As the amount of sand increased, the percentage amounts of the nutritive constituents of the soil which were assimilated also increased. In pots 1 (barley), with soil alone, and 4 (soil with 3 parts of sand), the percentage amounts utilised by the plants were: N, 27.3 and 58.5; K₂O, 37.9 and 86.8; CaO, 3.5 and 8.2; P₂O₅, 30.2 and 72.5. It is concluded that light sandy soils require plenty of manure, not only because they are poor in nutritive substances, but because the assimilating power of plants is greater in sandy than in heavier soils.

N. H. J. M.

Relation between the Weight and the Percentage of Nitrogen in Barley Grain. By WILHELM JOHANNSEN (*Bied. Centr.*, 1900, 29, 110—112; from *Meddel. Carlsberg. Lab.*, 1899, 4, 228—313).—Ripe, completely developed grains from different ears of the same variety of barley, grown on a small experimental bed, showed great variations in the percentage of nitrogen; an average analysis of barley grain is therefore insufficient for determining the quality, from a chemical point of view, of the crop. The different ears from one plant do not as a rule vary much in composition, but occasionally they varied a good deal. This lends support to the view that the nature of an entire plant and not of a part of the plant should be

taken into account in selecting for the purpose of obtaining improved varieties.

The percentage of nitrogen generally increased with the weight of the grain; but the different series showed considerable variations, the rise in percentage of nitrogen being sometimes great, and sometimes hardly appreciable. Ears, with large grain and low percentage of nitrogen, selected for three generations, gave, in the fourth generation, grain which was somewhat heavier, and which contained distinctly less nitrogen than the grain of previous crops.

The author considers that the doctrine of the "incompatibility of the valuable properties of cultivated plants," advocated by Schindler and von Proskowetz, is of very limited scientific value, and that, practically, it only means that certain improvements are more difficult to obtain than others.

N. H. J. M.

Fenugreek. By GIUSEPPE D'ANCONA (*Landw. Versuchs.-Stat.*, 1899, 51, 387—396. Compare Pasqualini, *Ann. Staz.-Agrar. Forlì*, 1873, 1874, and 1876; and Jahns, *Abstr.*, 1886, 85).—Analysis of two samples of fenugreek gave the following results: Nitrogenous matter, 13.74 and 13.02; fat, 3.31 and 3.54; crude fibre, 31.75 and 29.36; nitrogen-free extract, 45.79 and 48.14; ash, 5.42 and 5.94 per cent. in the dry matter. The pure ash contained (per cent.):

	K ₂ O.	Na ₂ O.	CaO.	MgO.	Fe ₂ O ₃ .	P ₂ O ₅ .	SO ₃ .	SiO ₂ .	Cl.
1.	19.37	7.60	30.73	1.19	4.71	8.24	4.35	21.97	1.23
2.	18.85	7.55	28.92	0.96	5.08	7.87	3.91	25.19	0.99

In composition, fenugreek resembles *Trifolium incarnatum*. Its cultivation is recommended on account of the large crops which can be got without making a great demand on the soil. There seems to be no doubt that feeding with fenugreek gives rise to an unpleasant taste both in meat and in milk, and it is suggested that the fodder might be employed for working animals. The peculiar odour of the plants observed in April and May disappears, however, at the time of cutting. The odour is attributed to the presence of an oil (Jahns, *loc. cit.*).

N. H. J. M.

Amount of Mineral Matter and Nitrogen in Sugar Beet variously manured and in different Soils. By W. SCHNEIDEWIND (*Bied. Centr.*, 1900, 29, 81—84; from *Blätt. Zuckerrübenbau*, 1899, 6, 145).—The results of several years' experiments showed that the amount of sugar in fresh beet generally varies, in single years, inversely with the amount of ash. When the plants take up much potash, the percentage of sugar is only lowered when the amount of ash exceeds a certain limit; a slight increase in the amount of ash, when due to potash, will even raise the percentage of sugar.

In wet soils, the plants take up more water and mineral matter, but this does not involve greater production of organic non-saccharine matter. Except on peat land, the better kinds of beet contain very little ash compared with the varieties formerly grown; even when heavily manured with nitrate or with dung and nitrate, the percentage of ash remains low. Application of large amounts of manure results

in a high percentage of ash in the leaves, and the production of leaf is increased by large amounts of nitrogenous manure.

In the first periods of growth, sodium nitrate is more effective than potassium nitrate, owing, it is thought, to its being more readily soluble and diffusible, and to the fact that soda is not, like potash, absorbed by the soil. At the present time, sugar-beet contains only about half as much potassium and about twice as much sodium as formerly. As regards magnesium, the amounts present in roots have not changed much, but the leaves contain a good deal less than formerly. In the case of phosphoric acid, the roots contain less than formerly, whilst in the leaves the amount has remained the same. The employment of Stassfurt salts does affect the percentage of sugar, as the chlorides are stored in the leaves; the presence of chlorides is, besides, beneficial, since they diminish the amount of organic acids to which the production of molasses is mainly due. N. H. J. M.

Use of Commercial Fertilisers for Forcing House Crops. By EDWARD H. JENKINS and W. E. BRITTON (*21st Annual Rep. Agr. Exper. Stat. Connecticut* for 1897, 278—308. Compare Abstr., 1899, ii, 511).—*Tomatoes.* A mixture of coal ashes and peat with chemical manures gave greater yields than a rich compost of peat and manure. The greatest yield was obtained after application of sodium nitrate, 6·4 lb., dissolved bone black, 1 lb., and ammonium chloride, 2·4 lb. per 100 square feet. In presence of large amounts of soluble plant food in ashes and peat, the root system is much less extensive than in the case of plants growing in compost.

The experiments with carnations and radishes (*loc. cit.*) were also continued. N. H. J. M.

Vegetation Experiments with Sugar Beet. By H. WILFARTH and G. WIMMER (*Zeit. Ver. Deut. Zucker-Ind.*, 1900, 173—194).—The cultivation of sugar beet involves greater difficulties than is the case with cereals, potatoes, tobacco, &c., the quality as well as the yield being affected by unsuitable conditions. Variations in quality occur chiefly in the percentage of sugar and in the quotient; and not only the total nitrogen, but especially the amount of amides, has to be considered.

Excess or deficiency of water, nitrogen, and potassium are the conditions which most affect the beet-crop; and large amounts of nitrogen are only permissible when other conditions are satisfactory. The tendency to rot is shown to be connected with an alkaline secretion, due to the separation of the bases of the nitrate. To overcome this difficulty, gypsum is applied in conjunction with potassium nitrate, and the amount of humus is increased by addition of peat. Even when calcium nitrate is employed, lime may be liberated more quickly than it can be converted into carbonate. In dry seasons, abundance of potassium seems to compensate for deficiency of water.

Amides were determined by boiling the pulp (50 grams) with water (250—300 c.c.) and hydrochloric acid of sp. gr. 1·124 (6 c.c.) for half an hour, and distilling with *magnesia usta* into standard sulphuric acid.

Paraffin is added to prevent frothing. The small amounts of ammonia produced from proteids, &c., are not of practical importance.

N. H. J. M.

Does Nitrogenous Manure injure succeeding Crops when applied to Seed Beet? By H. WILFARTH (*Zeit. Ver. Deut. Zucker-Ind.*, 1900, 58—65).—The results of the author's experiments indicate that heavy applications of nitrogenous manure to sugar-beet grown for seed have no injurious effect on subsequent crops grown from the seed so obtained. The conclusion accords with what has been observed in practice (compare Rimpau, *Oesterr. Zeit. Zuckerind.*, 19, 615; Marek, *ibid.*, 1885, 768; Strohmer, Briem, and Stift, *ibid.*, 1892, 21, 244; and 1895, 279, 788, and Abstr., 1896, ii, 538; and Drechsler, *J. Landw.*, 1877, 117).

N. H. J. M.

Analytical Chemistry.

Gas Absorption Apparatus. By ARMAND GAUTIER (*Bull. Soc. Chim.*, 1900, [iii], 23, 141—144).—The apparatus consists of two bulbs, each of about 10 c.c. capacity, connected together by a straight, vertical tube 10—12 cm. long, reaching nearly to the bottom of the lower bulb, and also by a long spiral wound round the vertical tube. The gas first enters the lower bulb and then ascends the spiral, where it is broken up into a series of small bubbles and brought into intimate contact with the absorbing liquid, which subsequently descends into the lower bulb by means of the straight, vertical tube. The apparatus is compact, readily weighed with accuracy, and very efficient.

N. L.

Estimation of Iodic Acid in Sodium Nitrate. By R. AUZENAT (*Chem. Centr.*, 1900, i, 571; from *Mon. sci.*, [iv], 14, i, 72).—Both nitrates and iodates liberate iodine from potassium iodide on addition of sulphuric acid, but only the latter do so when acetic acid is used. A colorimetric estimation is based on this fact.

M. J. S.

Estimation of Sulphites and Thiosulphates in the presence of each other. By GEORG LUNGE and D. SEGALLER (*J. Soc. Chem. Ind.*, 1900, 19, 221—223).—The authors state that the unsatisfactory results obtained by Richardson and Akroyd with Lunge and Smith's process for the estimation of mixed sulphites and thiosulphates by means of standard iodine and potassium permanganate (*ibid.*, 1883, 2, 463) were caused by their not exactly following the directions laid down in the original paper. The process has been tried again with results quite as satisfactory as those given by Richardson and Akroyd's own process (Abstr., 1898, ii, 91).

In Lunge and Smith's process, there are only two titrations to be made, whilst in Richardson and Akroyd's process there are three; the former method is consequently the more expeditious.

L. DE K.

Estimation of Phosphoric Acid soluble in 2 per cent. Citric Acid Solution. By ALEXANDER HERZFELD (*Zeit. Ver. Deut. Zucker-Ind.*, 1900, 77—78).—The abnormal result previously described (this vol., ii, 243) was due to the want of full details of the method employed by the German Experiment Stations.

The method, which has been published by Wagner, is as follows: a half-litre flask containing alcohol (5 c.c.) and the basic slag (5 grams) is filled to the mark with 2 per cent. citric acid solution (at 17.5°), placed at once in a rotary apparatus (turning 30—40 times a minute) for half an hour, and then immediately filtered.

(1) 50 c.c. of the filtrate are treated with molybdate solution (100 c.c.), placed for 10—15 minutes in a water-bath heated at 60° or 90—95°. When cold, the precipitate is collected, washed with 1 per cent. nitric acid, and dissolved in about 100 c.c. of cold 2 per cent. ammonia. The solution is precipitated with 15 c.c. of magnesia mixture, being well stirred, and left for about 2 hours.

(2) 50 c.c. of the extract is at once treated with 50 c.c. of magnesia mixture containing citrate, and stirred, or violently agitated, for 30 minutes. The precipitate is filtered within half an hour.

N. H. J. M.

Volumetric Estimation of Boric Acid. By BERNHARD FISCHER (*Zeit. Unters. Nahr. Genussm.*, 1900, 3, 17—21).—To obtain accurate results by Jörgensen's method, the following precautions should be observed. The boric acid should be in combination with potassium or sodium. Organic matter should be destroyed by incineration, which may be carried to complete fusion if a little alkali carbonate is added. The aqueous solution of the fused mass is coloured by methyl-orange, and dilute sulphuric acid is added in the cold until the mixture is distinctly red. A few drops more acid are added, and the liquid is boiled for a moment to expel carbon dioxide. The liquid, which has become yellow on heating, is again completely cooled, when the red colour should return. It is then accurately neutralised, by first adding sodium hydroxide until yellow, and then $N/2$ sulphuric acid until the transition tint is obtained. Glycerol and phenolphthalein are added, and the acidity is estimated with $N/2$ soda. When the red colour is obtained, it is well to add a further quantity of glycerol, and if no more soda is then required than that necessary for the acidity of the glycerol itself (which should always be estimated and allowed for), the titration may be regarded as finished. With careful observations of the indicator tints the results are very close, and with such substances as margarine (saponified without using alcohol) are of almost theoretical accuracy; but the method is inapplicable to meat (compare Beythien and Hempel, this vol., ii, 313), since phosphates disturb the results seriously.

M. J. S.

Colorimetric Method for the Estimation of Silica in Mineral Waters. By ROBERTO SALVADORI and G. PELLINI (*Gazzetta*, 1900, 30, i, 191—194).—The estimation of silica by Jolles and Neurat's method (*Abstr.*, 1898, ii, 455) gives good results with the water of Bagnoli (*Abstr.*, 1899, ii, 771), but with waters containing a large proportion of salts, especially halogenated compounds, discordant

numbers are obtained. The presence of phosphoric or arsenic acid has no disturbing influence on the determination. The yellow colour with molybdic acid solution is just visible with a solution containing 0.003 gram of silica per litre, which must be regarded as the limit of sensitiveness of the method.

T. H. P.

Mechanical Analysis of Soils. Separation of Clay and Sand. By GIUSEPPE SCARLATA (*Chem. Centr.*, 1900, i, 571; from *Staz. sperim. agrar. ital.*, 32, 634).—About 5 grams of the soil are placed in a thin beaker, of 500 c.c. capacity, furnished at one side with a stop-cock syphon, and at the other with a stop-cock tube by which water can be admitted. The soil is acidified with hydrochloric acid, and water is added until it reaches to 2 cm. from the edge of the beaker, and while keeping the level constant, a slow stream of water is passed through the vessel, which meanwhile is gently warmed. When the supernatant liquid is perfectly clear, the flow of water should be stopped, and the contents of the beaker boiled; if the separation is complete, the liquid will remain clear. The results agree well with those obtained with Schloësing's apparatus.

M. J. S.

Detection of Mercury in Urine. By M. HOEHNEL (*Chem. Centr.*, 1900, i, 627—628; from *Pharm. Zeit.*, 45, 126).—1 litre of urine is concentrated on the water-bath to 250 c.c., 3—4 grams of pure potassium cyanide are added, and the whole heated for half an hour at 60—70°. Into the brown filtrate 2 or 3 strips of carefully cleaned copper foil are introduced, and the whole is left for 2 hours at 60—70°; the strips of copper are then taken out, washed with water and alcohol, and exposed for half an hour to the air. If the urine contained mercury, this will form the well-known deposit on the copper, which may be further verified in the usual manner.

L. DE K.

Clinical Estimation of Mercury in Urine. Elimination of Mercury in Patients treated with this Metal. By FRIEDRICH ESCHBAUM (*Chem. Centr.*, 1900, i, 628; from *Deut. med. Woch.*, 26, 52—55).—The process is briefly as follows. The urine is boiled with some dextrose, and a sufficient amount of aqueous sodium hydroxide is added to precipitate the phosphates. After pouring off the clear, supernatant liquid, the precipitate is dissolved in hydrochloric acid and then heated at 45—60° with copper gauze. This, after being duly washed with alkali, water, and alcohol, is dried for half an hour in the air and then heated in a glass tube; the mercury which condenses on the cold sides of the tube is removed by introducing a weighed piece of silver foil with which it instantly amalgamates. The increase in weight represents the mercury; by way of a check, the silver may be heated and the mercury found by the loss in weight.

The urine of patients treated with Werler's ointment, which contains 10 per cent. of colloidal mercury, showed, after 48 hours, distinct traces of mercury; this could still be detected for 6 weeks after the cure.

L. DE K.

Electrolytic Estimation of Lead in the Sulphate and Chromate. Application to the Analysis of Lead Glass and Lead Chromates. By CH. MARIE (*Compt. rend.*, 1900, 130, 1032—1033).—The lead sulphate or chromate is dissolved in a mix-

ture of nitric acid and ammonium nitrate, and the solution electrolysed at 60—70° in the usual manner. Lead glass is subjected to a preliminary treatment with sulphuric and hydrofluoric acids in order to convert the bases into sulphates. N. L.

Analysis of Copper. By JOHN CLARK (*J. Soc. Chem. Ind.*, 1900, 19, 27—28).—The solution, which must contain free hydrochloric acid, is mixed [with excess of potassium iodide and then with sufficient sodium sulphite to remove the free iodine. If the solution should contain free nitric or sulphuric acid, it must first be rendered alkaline with sodium carbonate, and afterwards be cleared by means of hydrochloric acid. The cuprous iodide, derived from at least 10 grams of the metal to be tested, is thrown on a filter and washed, first with dilute hydrochloric acid, and then with cold water. The filtrate is boiled until the sulphur dioxide is expelled, and then mixed with excess of ammonia or aqueous sodium hydroxide, which should not produce a precipitate; ammonium or sodium sulphide is added to precipitate the last traces of copper, and also any lead, bismuth, &c.; arsenic, tin, and antimony are not precipitated. By adding excess of hydrochloric acid and passing hydrogen sulphide, the arsenic, tin, and antimony are precipitated as sulphides, and may be separated by boiling in a distilling flask with strong hydrochloric acid, whereby the arsenic sulphide is decomposed and volatilised (*Trans.*, 1892, 61, 424); the arsenic may then be recovered from the distillate by means of hydrogen sulphide. The solution left in the flask, and containing the antimony and tin, is then boiled with steel turnings, which throw down the antimony as metal, and reduce the tin to the stannous state; this is precipitated as sulphide, and finally converted, as usual, into oxide and weighed. The antimony and the undissolved steel are dissolved in hydrochloric acid and potassium chlorate, precipitated with hydrogen sulphide, and the antimony finally weighed as sulphide.

The metals which have been precipitated with ammonium sulphide in the alkaline tartrate solution may be dissolved in hydrochloric acid and a little potassium chlorate, precipitated with hydrogen sulphide, and then redissolved by means of hydrochloric acid and potassium chlorate. The bismuth and copper are precipitated by means of steel turnings (see this vol., ii, 371), converted into sulphides, dissolved in nitric acid, and the bismuth thrown down with ammonium carbonate, and weighed as oxide. To the filtrate from the bismuth and copper, excess of sodium acetate is added, and any lead (unless this has already been removed before precipitating the copper with potassium iodide) is precipitated with sulphuric acid and weighed as sulphate. Iron, nickel, zinc, &c., are estimated in the usual way.

The process previously referred to for separating arsenic, antimony, and tin will be found very useful in qualitative analysis. The mixed sulphides are introduced into a small flask, mixed with about 20 c.c. of strong hydrochloric acid, and distilled into a test-tube containing water; if arsenic is present, a yellow precipitate, due to arsenic trisulphide, makes its appearance. The residual liquid is filtered, if necessary, boiled with steel (not iron) turnings to precipitate the antimony, and the filtrate tested for stannous tin with mercuric

chloride. The antimony is mechanically removed from the steel, then dissolved in hydrochloric acid and potassium chlorate, and its solution divided into two parts; in one of these, the antimony is tested for with hydrogen sulphide, and to the other the test with zinc on platinum foil is applied.

L. DE K.

Estimation of Copper in Cyanide Solutions. By J. E. CLENNELL (*J. Soc. Chem. Ind.*, 1900, 19, 14—16).—10 to 50 c.c. of the solution to be tested, which must be perfectly clear, are placed in a 100 c.c. flask, and *N*/10 sulphuric acid is added from a burette with continual shaking, until the turbidity formed ceases to disappear, but leaves the liquid slightly milky. After carefully reading the burette, a further quantity (A) of the acid is added, more than sufficient to precipitate the whole of the copper. The flask is now filled up to the mark with water and thoroughly shaken, when the precipitate will generally settle rapidly in a flocculent condition. 50 c.c. of the supernatant liquid are now filtered and titrated with *N*/10 solution of sodium carbonate, a single drop of methyl-orange (1:400) serving as indicator. The strength of the sodium carbonate solution must be accurately determined with reference to the sulphuric acid used in the first stage of the test. The number of c.c. of sodium carbonate used, multiplied by 2, gives approximately the equivalent of the excess of sulphuric acid beyond that required to precipitate the copper.

Let B represent the number of c.c. of sodium carbonate used for 50 c.c. of the filtrate, and C the number of c.c. of sulphuric acid equivalent to 2B, then $A - C$ represents the number of c.c. of sulphuric acid equivalent to the copper present.

L. DE K.

[Analysis of] Molybdenum Sulphides. By MARCEL GUICHARD (*Bull. Soc. Chim.*, 1900, [iii], 23, 147—156).—The preparation of molybdenum disulphide and sesquisulphide has been already described (this vol., ii, 144 and 211); in the present paper an account of the analytical methods employed is also given. The sulphides are decomposed by heating with nitric acid or by fusion with potassium nitrate and sodium carbonate, and the nitric acid removed by evaporation with hydrochloric acid; the sulphuric and molybdic acids thus formed are finally weighed as the barium and lead salts respectively. The molybdenum alone may be estimated by igniting the sulphide, with or without previous treatment with nitric acid, at a temperature below redness, and weighing the residue of molybdenum trioxide. Molybdenite may be conveniently heated to bright redness in a current of oxygen when molybdenum trioxide sublimes, whilst the iron and silica are found in the residue.

N. L.

Phosphotungstic Acid as a Reagent for Potassium. By EMIL WÖRNER (*Chem. Centr.*, 1900, i, 517; from *Ber. Deut. pharm. Ges.*, 10, 4).—Neutral or acid solutions of potassium and ammonium salts give a white precipitate with phosphotungstic acid. Slight warming favours, alcohol hinders, the precipitation. To distinguish potassium from ammonium, the precipitate may be boiled with sodium hydroxide, and after acidifying with hydrochloric acid, the reagent added afresh. A fraction of a milligram of potassium chloride gives the reaction distinctly.

M. J. S.

Separation of Bismuth from Lead. By JOHN CLARK (*J. Soc. Chem. Ind.*, 1900, 19, 26—27).—The solution containing the two metals, which should be in the form of chlorides, is boiled with steel turnings which rapidly bring down the bismuth; care must be taken to have a slight excess of the steel, as otherwise a portion of the bismuth will redissolve.

The bismuth and the undissolved steel are washed with water, dissolved in hydrochloric acid with the aid of potassium chlorate, and the bismuth is then precipitated as sulphide; this, after being thoroughly washed free from iron, is dissolved in nitric acid and precipitated with ammonium carbonate. The bismuth carbonate is then converted into oxide and weighed.

L. DE K.

Detection of Minute Quantities of Gold in Ores. By THEODOR DÖRING (*Chem. Centr.*, 1900, i, 516—517; from *Berg.-Hüttenm.*, 59, 49).—Otto has shown that a white, infusible ash of paper acquires a rose-red to purple coloration if the paper has been soaked in a solution which leaves metallic gold when ignited, and has suggested the extraction of ores with either tincture of iodine or bromine water for the purpose. The author finds the most efficient solvents to be a mixture of ether and bromine, or one of equal volumes of bromine and aqueous hydrobromic acid of sp. gr. 1.49. An aqueous solution of iodine in hydriodic acid also dissolves gold readily. Otto's method will detect 0.75 gram of gold in a ton of ore.

M. J. S.

New Microchemical Reaction of Palladium. By M. E. Pozzi-Escot and H. C. Couquet (*Compt. rend.*, 1900, 130, 1073).—If, after the addition of potassium nitrite to a solution of palladium chloride, an excess of an alkali hydroxide or ammonia is immediately added, the temperature of the mixture being kept low, a palladium potassium nitrite is formed which is deposited as slightly yellow, rhombohedral crystals. This microchemical reaction is a characteristic and delicate test for palladium salts.

H. R. LE S.

Estimation of Iridium in Alloys of the Noble Metals. By W. MIETZSCHKE (*Chem. Centr.*, 1900, i, 572—573; from *Berg.-Hüttenm. Zeit.*, 59, 61).—To extract the iridium from an alloy containing gold, silver, and platinum, with or without oxidisable metals, four quantities of 0.25 gram are taken, cupelled, fused with silver (quartated), and two of the buttons boiled with nitric acid, two with sulphuric acid. The gold is submitted to quartation a second time, and then boiled with nitric acid, by which means silver and platinum are removed. Part of the iridium will be found floating in the silver solution, which should be filtered to recover it. The iridium-gold is dissolved in aqua regia, when most of the iridium will be left undissolved. The gold is thrown down by ferrous sulphate, and the remainder of the iridium is obtained by evaporating the filtrate.

If the iridium-gold alloy is free from other metals, it may be fused in a crucible in a muffle, and kept at a high temperature for 1—2 hours. The whole of the iridium will deposit on the crucible. After pouring off the fused gold, litharge and a reducing flux with a cover

of common salt are fused in the crucible ; the lead button is cupelled with much silver and the silver alloy examined for iridium. M. J. S.

Method and Apparatus for Incinerating Vegetable and Animal Substances. By A. E. SHUTTLEWORTH (*Bied. Centr.*, 1900, 29, 117—121; from *J. Landw.*, 1899, 47, 173; and *Inaug.-Diss.*, Göttingen, 1899. Compare Shuttleworth and Tollens, this vol., ii, 111).—Fusion of ash, and the consequent increase in the amount of ash constituents insoluble in hydrochloric acid, is avoided by addition of calcium acetate (compare Wackenroder, *Arch. Pharm.*, [ii], '53, 9). Pure calcium acetate (free from magnesia) is prepared by dissolving marble in hydrochloric acid, and after separating the iron, precipitating as oxalate. This is well washed and afterwards ignited, and the lime dissolved in boiling dilute acetic acid. A 1 per cent. solution is convenient, 20 c.c. being employed for 5—6 grams of oat straw, sufficient water being added to enable the acetate to be properly distributed. The amount of lime corresponding with the acetate employed is deducted from the weight of the ash.

The apparatus for incinerating consists of a deep dish, several covers and caps for covering the dish, and an air-pipe which passes through the cover and cap into the dish. The whole is made of platinum and weighs about 70 grams; a sketch is given in the original paper.

The method enables ashes to be prepared in less than four hours, without fusion or volatilisation of chlorides. The carbon dioxide in the ash can be determined in the apparatus. N. H. J. M.

Estimation of Naphthalene in Coal Gas. By HAROLD G. COLMAN and JAMES F. SMITH (*J. Soc. Chem. Ind.*, 1900, 19, 128—130).—The process employed is based on that adopted by Küster (*Abstr.*, 1894, ii, 333) for the separation of naphthalene from other solid hydrocarbons which do not form stable compounds with picric acid. The gas to be tested is passed by means of a specially constructed apparatus through a series of absorption bottles filled with a standardised solution of picric acid; this forms an insoluble compound with naphthalene, and the excess of picric acid is then titrated with decinormal barium hydroxide, using lacmoid as indicator. L. DE K.

Volumetric Estimation of Iodoform in Dressings. By MARTIN LEHMANN (*Chem. Centr.*, 1900, 19, 693; from *Pharm. Zeit.*, 45).—10 grams of the material are treated in a stoppered bottle with 100 grams of "spiritus æthereus" at 15—20° for 30 minutes with frequent shaking. 10 grams of the solution are mixed in an Erlenmeyer flask with 15—20 drops of fuming nitric acid, an excess of *N*/10 silver nitrate is added, and the whole heated on the water-bath until the silver iodide has deposited and the supernatant liquid is colourless. When cold, the liquid is diluted with 125—140 c.c. of water, and the excess of silver titrated according to Volhard's directions. L. DE K.

Some Analyses of Modern "Dry" Champagne. By OTTO ROSENHEIM and PHILIP SCHIDROWITZ (*Analyst*, 1900, 25, 6—8).—A table is given showing the analysis of 13 representative samples of modern "dry" French champagne.

Carbon dioxide was estimated by regulating the flow of gas by means of a hollow corkscrew with an accurately-fitting tap, drying the gas by means of sulphuric acid, and absorbing it in a weighed soda-lime tube, the last traces of gas being removed from the liquid by heating in a water-bath and transmitting a current of pure air.

The other figures were obtained by working according to the instructions laid down in the German Wine Law, 1896, and include: specific gravity at 15°, rotation in 20 cm. tube, alcohol by weight, free acidity calculated as tartaric acid, volatile acidity calculated as acetic acid, extract, ash, total tartaric acid, sugar as invert sugar, glycerol, extract (sugar - 1), and the relation of reduced extract and ash.

L. DE K.

Isolation of Pentose and Methylpentose [from Urine]. By PETER BERGELL and FERDINAND BLUMENTHAL (*Chem. Centr.*, 1900, i, 518; from *Arch. Anat. Phys.*, 1900, 155).—Several litres of urine are feebly acidified with sulphuric acid and concentrated on the water-bath to 300 c.c. The liquid is then decolorised with animal charcoal and made alkaline with barium hydroxide. After filtration, double the volume of alcohol is added, whereon the barium compound, $(C_5H_{10}O_5)_2 + BaO$, is precipitated, if at least 1.5 per cent. of pentose is present. If less is present, dextrose should be added, the barium compound of which will carry down the pentose. Methylpentose does not yield a barium compound of sparing solubility in alcohol.

M. J. S.

Estimation of Sugar in Glycerin-soaps. By FRANZ FREYER (*Chem. Centr.*, 1900, i, 693—694; from *Oesterr. Chem. Zeit.*, 3, 25—26).—16.28 grams of the soap are dissolved in 50—100 c.c. of water on the water-bath, a slight excess of 10 per cent. solution of barium chloride is added, and the whole diluted to 260 c.c., the extra 10 c.c. being supposed to compensate for the volume occupied by the barium soap.

The filtrate is then tested, as usual, for sucrose, by means of the polariscope before and after inversion; or Fehling's solution may be used.

L. DE K.

Automatic Apparatus for the Estimation of Pentosans. By VL. STANĚK (*Zeit. Zuckerind. Böhm.*, 24, 227—230).—In the Chalmot-Tollens method of estimating pentosans by distilling with 12 per cent. hydrochloric acid, after each 30 c.c. of distillate has collected, 30 c.c. of fresh acid are added to the distilling flask. To avoid the constant attention required by the ordinary method of carrying out this process, an apparatus has been devised by which the necessary additions of fresh acid are made automatically. An electrical indicator comes into action when the total distillate reaches any desired volume.

T. H. P.

Estimation of Formaldehyde. By JULES WOLFF (*Zeit. Unters. Nahr. Genussm.*, 1900, 3, 87—93).—For concentrated formaldehyde solutions, Blank and Finkenbeiner's method (*Abstr.*, 1899, ii, 188) is employed with slight modifications. A quantity of the substance containing about 0.4 gram of formaldehyde is treated with 10 c.c. of

3*N* sodium hydroxide, and 15 c.c. of hydrogen peroxide of 12 volumes per cent. previously diluted to 50 c.c. with water. A stronger peroxide solution is to be avoided. The reaction is complete in 10—15 minutes. Any acidity in either the hydrogen peroxide or the formaldehyde solution is estimated and allowed for. For solutions containing only traces of formaldehyde, a colorimetric process, based on Trillat's reaction (Abstr., 1899, ii, 130) may be used. A measured quantity of the solution is placed in a stoppered 50 c.c. flask, and mixed with 1 c.c. of glacial acetic acid and 1 c.c. of dimethylaniline; the flask is shaken for 2 minutes and then heated for 4—5 hours at 60°, keeping closely stoppered. Comparative estimations with solutions of known strength, and one without formaldehyde, are started and carried on simultaneously. Each mixture is then transferred to a small distillation flask, and after making feebly alkaline with sodium hydroxide (using phenolphthalein as indicator), 30 c.c. are distilled from it to remove excess of dimethylaniline. The residue is then acidified with acetic acid, and all the solutions are made up to the same volume. Equal quantities are now placed in test-tubes of equal diameter and mixed with lead peroxide suspended in water (4 grams per litre), adding sufficient to develop the blue colour to its fullest extent. The final comparisons are made after heating the contents of the tubes to boiling. The limit to the detection of formaldehyde by this reaction is 0.56 mg. in 50 c.c. If much alcohol is present, the liquid must be diluted five-fold with water, and the mixture with dimethylaniline must not be warmed, but should be left for 20 hours at 15—20°. The comparison solutions should be made up with the addition of the same amount of pure alcohol as in the quantity of substance taken.

M. J. S.

Testing of Acetone. By JAMES T. CONBOY (*J. Soc. Chem. Ind.*, 1900, 19, 206—209).—According to the specification issued by the Government, acetone should show the following properties: (1) It should have a sp. gr. of 0.800 at 60° F. Mixed with distilled water, it must show no turbidity, and must leave no residue on evaporation at 212° F. On distillation, 80 per cent. by volume should distil over below 138° F. The liquid left in the distilling flask should not contain any ingredient foreign to crude acetone. (2) 1 c.c. of a solution of potassium permanganate (1:1000) added to 100 c.c. of the sample should retain its distinctive colour for not less than 30 minutes. (3) The sample should not show more than 0.005 per cent. of acetic acid when tested as follows: 50 c.c. are diluted with 50 c.c. of distilled water, mixed with 2 c.c. of solution of phenolphthalein (1:1000 proof spirit) and then titrated with *N*/100 soda.

Commenting on these tests, the author calls attention to the influence exercised by the temperature on the permanganate test; a definite temperature should therefore be fixed. When estimating the acidity, great care should be taken to use distilled water completely free from carbon dioxide, and blowing the pipette should be avoided. It is also stated that samples which are to be submitted to these tests should not be exposed to light, as the effect will be prejudicial.

L. DE K.

Examination of Violet Preparations for Ionone. By R. SCHMIDT (*Zeit. angew. Chem.*, 1900, 189—192).—A crude oil is first isolated, in the case of an alcoholic solution by diluting it with water and extracting it with ether; in the case of a pomade by distilling it with steam and extracting the distillate with ether. The crude oil left on evaporation of the ether must itself be employed for estimations; for qualitative tests, it may be distilled under reduced pressure, and the fraction boiling at 125—135° under 12 mm. pressure utilised.

As a preliminary experiment, a little of the oil may be mixed with an acetic acid solution of *p*-bromophenylhydrazine. The crude hydrazones of α - and β -ionone melt at 138—140° and 110—115° respectively; the pure substances melt at 143° and 118°.

In order to isolate the ketones, the crude oil is shaken with a slightly acid solution of sodium *p*-hydrazinebenzenesulphonate, then made slightly alkaline, and shaken with ether and so much ammonium sulphate as will cause a separation into three layers, the ethereal layer being removed and renewed frequently. The two aqueous layers are together treated with phthalic anhydride, and distilled with steam; the distillate is extracted with ether, and the ethereal solution distilled. A loss of 10 per cent. is inevitable. For qualitative tests, the crude ketones may be distilled, and the fraction boiling at 125—135° under 12 mm. pressure employed.

In order to separate and detect the α - and β -ionone, the crude ketones are boiled with a little alcohol and an aqueous solution of sodium sulphite and hydrogen sulphite. The solution is purified by extraction with ether, and then distilled, when β -ionone passes over, and may be identified by means of its semicarbazone, which melts at 148°. Sodium hydroxide is added to the residue, and the distillation continued, when α -ionone passes over; it may be identified by means of its *p*-bromophenylhydrazone.

The method last described permits of the detection of a small amount of β -ionone in the presence of much α -ionone. In order to detect a little α -ionone in presence of much β -ionone, the semicarbazones are prepared under such conditions that all of the α - and some of the β -semicarbazone remain dissolved, whilst much of the latter separates. The alcoholic mother liquor is warmed with dilute sulphuric acid and then extracted with ether; the oil extracted is converted into the crude *p*-bromophenylhydrazone, by repeated crystallisation of which the pure α -derivative is obtained.

Exact details of the processes are given in the paper. C. F. B.

Estimation of Propionic and Butyric Acids in Acetic Acid. By MAX MUSPRATT (*J. Soc. Chem. Ind.*, 1900, 19, 204—206).—If the acetic acid is known to contain either propionic or butyric acid (usually isobutyric acid), the amount may be estimated indirectly by first titrating the mixture with pure sodium hydroxide and afterwards weighing the mixed anhydrous sodium salts.

If both propionic and isobutyric acids are suspected, the mixture is neutralised within about 5 per cent., and distilled to dryness. A convenient quantity of the distillate is then carefully neutralised with sodium carbonate, and evaporated in a platinum dish. From the weight

of the anhydrous salt and the acidity of the distillate, the results are calculated as acetate and isobutyrate. Sufficient absolute alcohol is now added to dissolve the butyrates, and after evaporating the solution, the residue is weighed, ignited, and titrated. The isobutyrate calculated from this should agree with that found previously, unless propionic acid is present.

If the results do not agree, the presence of propionic acid is assured. The author recommends for its detection the process recommended by Linnemann, which is based on the insolubility of basic lead propionate in boiling water. As, however, the basic lead salt of *n*-butyric acid is also very insoluble, *n*-butyric acid interferes with the test.

L. DE K.

Separation of Oleic Acid from other Fatty Acids. By JULIUS LEWKOWITSCH (*Analyst*, 1900, 25, 64—66).—The process recommended by Twitchell, based on the insolubility of sulphonated oleic acid in light petroleum (Abstr., 1899, ii, 69), and that recommended by Farnsteiner, based on the insolubility of barium oleate in a mixture of benzene and alcohol (Abstr., 1899, ii, 705), are found to be untrustworthy.

L. DE K.

Free Fatty Acid in Olive Oil. By RUSSELL W. MOORE (*J. Soc. Chem. Ind.*, 1900, 19, 223).—7.05 grams of the oil are introduced into a 4 oz. bottle by means of an accurate pipette, 50 c.c. of a 10 per cent. sodium chloride solution are added, and the free acids titrated with *N*/4 alkali, using phenolphthalein as indicator, and thoroughly shaking the mixture after each addition of alkali.

The number of c.c. of alkali used represent the percentage of free (oleic) acid in the sample. The process can also be used for solid fats by employing hot sodium chloride solution.

L. DE K.

Determination of the Iodine Value. By J. J. A. WILS (*Analyst*, 1900, 25, 31—33. Compare Lewkowitsch, this vol., ii, 323).—A controversy with Lewkowitsch on some minor points in the determination of the iodine value by means of a solution of iodine monochloride in acetic acid.

The author agrees that allyl alcohol is not a substance specially suitable for deciding the respective values of the different methods for determining iodine values. Lewkowitsch's objection to the use of acetic acid of 95 instead of 99 per cent. strength is overruled.

L. DE K.

The Iodine Value of Oils. By ARTHUR MARSHALL (*J. Soc. Chem. Ind.*, 1900, 19, 213—215).—A solution of iodine monochloride in pure carbon tetrachloride is recommended instead of the ordinary Hübl solution, as it may be obtained perfectly free from any moisture, thus preventing secondary actions.

L. DE K.

Relation between the Specific Gravity, Fat, and Solids not Fat, in Milk. By NORMAN LEONARD (*Analyst*, 1900, 25, 67—69).—This is a slight modification of the formula proposed by Richmond in 1895: $T = 0.25, G + 1.2, F + 0.14$, in which *T* represents the total solids, *G* the excess of the sp. gr. over 1000, and *F* the fat.

The new formula given is $F=0.796$, $T=0.210$, $G=+0.30$.

Both formulæ give, however, practically the same results, and it is only in the case of rich milks that the difference may amount to more than 0.1 per cent.

L. DE K.

Adulteration of Cotton-seed Oil with Maize Oil. By GIULIO MORPURGO and ALB. GÖTZL (*Chem. Centr.*, 1900, 1, 694—695; from *Oesterr. Chem. Zeit.*, 3, 53—54).—The two oils are chiefly distinguished by their iodine numbers, and by the melting points of their fatty acids. The iodine numbers of cotton-seed oil and maize oil are respectively 111—113 and 130.2—151.4; the melting points of the fatty acids, 36—37° and 18—20°. Notwithstanding this, 25 per cent. of maize oil may be added to cotton-seed oil without its presence being readily detected.

L. DE K.

Detection of Margarine in Cheese. By G. FASOETTI and F. GHIGI (*Chem. Centr.*, 1900, i, 573—574; from *Staz. sperim. agrar. ital.*, 32, 593).—The solvent employed to extract the fat from cheese must be one which does not alter it in any respect; the cheese should therefore first be extracted with water at 30—35°, and then the fat dissolved out with ether. Leffmann and Beam's modification of the Reichert-Meissl method avoids certain sources of error and saves time. In genuine cheese, the volatile acid number exceeds 18, margarine cheese gives values below 15, and generally below 6. As shown by Windisch, the proportion of free acids of both natural and artificial cheese-fats is but little affected by the ordinary conditions of ripening. The refraction values at 35° of genuine cheese lie below 47.5°, those of margarine cheese above 48°, but the latter fall during ripening. Complete analyses of four margarine cheeses are given in the original paper.

M. J. S.

Some Properties of Rosin, with Special Reference to the Analysis of the Fatty Matter of Soap. By ALFRED SMETHAM and F. ROBERTSON DODD (*J. Soc. Chem. Ind.*, 1900, 19, 101—103).—It is shown that the iodine number of rosin is much reduced by the saponification process, although the saponification and acid values are not much affected thereby; this is of some importance when dealing with saponified rosins in the analysis of the mixed fatty acids of soap. But the fact that the iodine number is so high, that it much depends on the process employed (Hübl's, Wijs's), and that it is after all very uncertain, renders its direct application to soap analysis of doubtful value.

L. DE K.

Detection of "Saccharin" in Articles of Food. By R. TRUCHON (*Chem. Centr.*, 1900, i, 691; from *Ann. Chim. anal. appl.*, 5, 48—49).—The following modification of Schmitt's process is used in the Paris official laboratory: 200 c.c. of the liquid to be tested are acidified with phosphoric acid and shaken three times in succession with 35—40 c.c. of a mixture of ether and light petroleum; the ethereal liquid is washed with water and then evaporated in a platinum dish. 5—6 drops of aqueous sodium hydroxide are added to the residue and the whole gently fused over a small flame of a Bunsen burner until no more gas bubbles are noticed. The fused mass is dissolved in water,

acidified with sulphuric acid, and extracted twice in succession with 30 c.c. of benzene; this is allowed to evaporate in a porcelain dish and the residue is then tested for salicylic acid with ferric chloride.

L. DE K.

Technical Analysis of Liquorice Pastes. By M. TRUBECK (*J. Amer. Chem. Soc.*, 1900, 22, 19—21).—Hager's process, in which ammonia and alcohol are used, gives quite erroneous results when liquorice paste contains added glucose, as the percentage of glycyrrhizin so found may then be as much as 10 per cent. in excess of the truth. The following process is recommended: 2 grams of the sample are well stirred with 5 c.c. of warm water, and 20 c.c. of alcohol are added; the liquid is filtered, and the residue washed with dilute alcohol (1:4) until the washings are colourless. The residue is then dried at 105° and weighed; it represents the gummy matter, starch, &c. The filtrate is evaporated, finally in a small beaker, to 1 or 1.5 c.c., then dissolved in 2 c.c. of glacial acetic acid and mixed with 30 c.c. of absolute alcohol. The crude glycyrrhizic acid is then collected on a weighed filter, washed with absolute alcohol, dried at 105° for 3 hours and weighed, then incinerated, finally heating over the blow-pipe, and any ash so obtained weighed, and 0.7 of its weight deducted from the weight of the acid.

The filtrate from the glycyrrhizin is evaporated, the residue is moistened a few times with water, and finally dried for 3 hours at 105° and weighed; this represents saccharin matters, tannins, resins, &c.

The estimation of water, ash, matters soluble in cold water, and saccharin matters is effected in the usual manner.

L. DE K.

Colour Reaction for Tyrosine. By GEORGES DENIGÈS (*Compt. rend.*, 1900, 130, 583—585).—2 c.c. of sulphuric acid are very carefully mixed with 3 to 5 drops of a solution of aldehyde in twice its volume of alcohol of 90°, care being taken that the liquid remains colourless. A few drops of a solution of tyrosine are then added, and the liquid rapidly acquires a gooseberry-red colour, the intensity of which is proportional, within certain limits, to the quantity of tyrosine present. In this way, it is possible to recognise tyrosine in a solution containing only 1 part in 10,000, if 0.1 c.c. of the solution is taken. By using solutions of tyrosine of known strength, the quantity of tyrosine in the liquid under examination may be rapidly estimated colorimetrically. The reagent is not affected by proteids and peptones, but is affected by certain phenolic compounds.

A solution of commercial formalin in 50 vols. of sulphuric acid gives with tyrosine a brown coloration which eventually becomes reddish. This colour changes to green if the liquid is mixed with twice its volume of glacial acetic acid and boiled.

C. H. B.

Detection of Phenetidine in Urine. By G. EDLEFSEN (*Chem. Centr.*, 1900, i, 573; from *Centr. inn. Med.*, 21, 2).—According to Müller (*Therap. Monatsh.*, 12, 357), phenetidine can be detected in the urine after doses of phenacetine by diazotising and adding an alkaline solution of α -naphthol. The author finds that Müller's alkaline ether extract of the urine does not always give the reaction, the phenetidine

being present as an ethyl sulphonate, which requires to be boiled with hydrochloric acid before it will give Müller's indonaphthol reaction. The cooled liquid is shaken with 1—2 drops of a 1 per cent. nitrite solution. One-half of the mixture is treated with a drop or two of 4—5 per cent. alcoholic α -naphthol and then made alkaline. In presence of phenetidine, a pure red coloration is produced, which becomes a deep cherry-red on acidifying with hydrochloric acid. The other half is treated with 1 to 2 c.c. of a 3 per cent. phenol solution and sodium hydroxide; a yellow coloration is obtained, passing into pale red on acidifying. Müller's method is only suitable when a larger amount of phenetidine is present.

M. J. S.

Reactions of Antipyrine, Tolpyrine, Aminoantipyrine and Pyramidone. By PAUL HOFFMANN (*Chem. Centr.*, 1900, i, 519; from *Arch. intern. Pharm. Therap.*, 1899, 171).—The reactions of these compounds are described with auric chloride, ferric chloride, the Brouardel-Boutmy reagent, silver nitrate, potassium dichromate, Wagner's reagent, nitrous acid, bromine water, and blood solution with hydrogen peroxide. Aminoantipyrine and pyramidone being more oxidisable than antipyrine and tolpyrine, reduce auric chloride in the cold, the two latter only on boiling. The two former give also blue or violet colours with nitrous acid, bromine water, blood, ferric chloride, and the Brouardel-Boutmy reagent, whilst the two latter either give no reaction or one of another colour. Aminoantipyrine and pyramidone may be distinguished by the last three of these reagents.

M. J. S.

Coffee Extracts, their Composition and Analysis. By CRESACRE G. MOOR and MARTIN PRIEST (*Analyst*, 1899, 24, 281—283).—The percentage of extract, ash, total nitrogen, and caffeine is given for 10 samples of commercial coffee extracts, including 4 samples which also contained chicory extract. The figures representing the percentage of caffeine are in fair agreement with those obtained by the analytical sanitary commission of the *Lancet* in 1894.

Attention is called to the difficulty of making a proper division of the sample into three parts for the purpose of official analysis, as most of the caffeine may be at the bottom of the bottle as a sparingly soluble tannate; if the sample is warmed, this will completely redissolve.

L. DE K.

Estimation of the Alkaloids of the Leaves of Datura Stramonium, Hyoscyamus Niger, and Atropa Belladonna. By ERNST SCHMIDT (*Chem. Centr.*, 1900, i, 376—377; from *Apoth. Zeit.*, 15, 13—14).—10 grams of the dried and powdered leaves are shaken with 90 grams of ether and 30 grams of chloroform, 10 c.c. of a 10 per cent. solution of sodium hydroxide added, and the whole frequently shaken for 3 hours; 10 c.c. of water are then added, and after an hour 60 grams of the clear chloroform-ether solution (= 5 grams of the leaves) are filtered. This is distilled to about one-half, and the residue shaken in a separating funnel with 10 c.c. *N*/100 hydrochloric acid. This is collected, and the chloroform is washed thrice with 10 c.c. of water. The acid solution is filtered,

the washings being also passed through the same filter, which is finally washed until the total filtrate measures 100 c.c. The liquid is covered with 1 cm. layer of ether, 5 drops of alcoholic solution of iodococsin (1:500) added, and the excess of acid titrated with *N*/100 potassium hydroxide until the aqueous layer turns pale rose-red. A blank experiment is then made in the same manner, and the amount of alkaloid is calculated from the hydrochloric acid used for its neutralisation.

L. DE K.

Detection of Nicotine. By IWAN SCHINDELMEISER (*Chem. Centr.*, 1900, i, 67; from *Pharm. Centralhalle*, 40, 703).—When treated with a drop of 30 per cent. formaldehyde (free from formic acid) and a drop of concentrated nitric acid, nicotine gives a rose-red solution. It is better to leave the mixture of nicotine and formaldehyde for some hours before adding the nitric acid. As little as 0.5 mg. of nicotine will show the reaction, which is not interfered with by coniine, piperidine, trimethylamine, pyridine, quinoline, picoline, or aniline. The reaction was not obtained with extracts of decomposing horse-flesh, or the intestines of animals poisoned by tin, mercury, or arsenic, extracted by the Stas-Otto process. Too much formaldehyde must not be added, nor must the mixture be warmed, as in either case explosive decomposition will occur.

M. J. S.

Ullmann's Tests for Tanning Materials and Basic Colours used in Dyeing. By ADOLF HEINEMANN (*Chem. Zeit.*, 1900, 24, 58).—The colorimetric tests by means of basic colours, proposed by Ullmann, are stated to give untrustworthy results, as they do not sufficiently distinguish between tannic acid and gallic acid, which is of no use as a mordant.

L. DE K.

Distinguishing Between Hops and Quassia. By ALFRED C. CHAPMAN (*Analyst*, 1900, 25, 35—37).—The process is based on the fact that hop bitter yields valeric acid when oxidised with an alkaline solution of potassium permanganate, whilst quassia and chiretta do not yield any; camomile extract, however, behaves in a similar manner to hops.

The beverage to be tested, beer, for instance, is evaporated to dryness with some sand; the mass is then dried in an air-bath, powdered and extracted with ether. The ether is filtered into a flask, and after recovering the bulk by distillation, the last traces are driven off by warming the flask on the water-bath. A solution containing 40 grams of potassium permanganate and 10 grams of potassium hydroxide per litre is now added in small portions until the permanganate ceases to be readily reduced; warming and shaking promote the action. The excess of permanganate is then reduced by adding a sufficiency of oxalic acid, and the filtered liquid evaporated in a glass dish. If now the residue is moistened with dilute sulphuric acid, the odour of valeric acid will at once become apparent if hop bitter is present; in the case of quassia, a faint odour of acetic acid will be noticed.

L. DE K.

General and Physical Chemistry.

Spectra of Metals in the Electric Arc. V. Spectrum of Vanadium. By H. HASSELBERG (*K. sv. vet. Akad. Handl.*, 1900, 32, 2).—After careful comparison with the spectra of iron, titanium, chromium, manganese, cobalt, and nickel, the author gives a full list of the lines he regards as belonging to vanadium. His results agree in the main with those of Rowland. J. C. P.

Transparency of Aluminium to Radiations from Radium. By HENRI BECQUEREL (*Compt. rend.*, 1900, 130, 1154—1157. Compare Abstr., 1899, ii, 393; this vol., ii, 126, 182).—A series of experiments which confirm the author's previous statements that when radiations from radium fall on an aluminium screen, some are absorbed, some diffused, and others transmitted; the last have properties identical with those of the incident radiations. Of the secondary radiations which are also emitted, some are deviated by the magnetic field, whereas others are not (compare Villard, *Compt. rend.*, 1900, 130, 1012). H. R. LE S.

Radiations from Radium. By P. VILLARD (*Compt. rend.*, 1900, 130, 1178—1179).—When the radiations from radium fall on a glass plate 1 cm. in thickness, or on a sheet of lead 0.3 mm. in thickness, practically all the radiations which are deviated by a magnetic field are absorbed, whereas the others (those not so deviated) are transmitted almost completely. H. R. LE S.

Theory of the Latent Image. By EUGEN ENGLISH (*Chem. Centr.*, 1900, i, 706; from *Arch. wiss. Phot.*, 2, 50—52).—According to Schaum, the small lateral extension of the darkening compared with its depth points to the capability of development being due to the action of chemically active rays, and not to that of silver germs. This fact, however, must not be quoted against the contact theory, as is done by Eder. The subhaloid theory is to be rejected because, according to it, the undeveloped fixed image should be twice as strong as the developed fixed image. It appears that an appreciable part of the silver bromide is altered in the light, and thus prepared for development. If this can be proved, both the silver germ and subhaloid theories must be given up (compare Abegg; Luther, this vol., ii, 253). J. C. P.

Reversibility of Voltaic Cells. By T. SIDNEY MOORE (*Phil. Mag.*, 1900, [v], 49, 491—496).—Experiments were made to test the reversibility of the following voltaic cells; copper and zinc in solutions of their sulphates and of their chlorides, copper and cadmium in solutions of sulphates or chlorides, and the Clark cell. The experimental method is described and the results indicate that all the cells examined were reversible, the slight differences in the E.M.F.'s observed being within the limits of experimental errors. L. M. J.

Alleged Identity of Red and Yellow Mercuric Oxides. II. By ERNST COHEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1900, 2, 458—460. Compare this vol., ii, 184).—The E.M.F. of the mercuric

oxide cell previously described increases from 0.685 millivolt at 25° to 0.773 millivolt at 35°, so that the temperature coefficient is 0.0088 millivolt. When this value is introduced in the equation

$$\pi = E/n\epsilon_0 + T.d\pi/dT,$$

E , the heat of transformation of the yellow into the red oxide, is calculated to be -89.4 cal. Varet found the heat of reaction of the red oxide with hydrocyanic acid to be 31550 cal., whilst Berthelot found 31600 cal. for the heat of reaction of the yellow oxide with the same acid. The difference of -50 cal. is of the same order as the value calculated above.

J. C. P.

Electrical Conductivity of Liquid Ammonia Solutions. By EDWARD C. FRANKLIN and CHARLES A. KRAUS (*Amer. Chem. J.*, 1900, 23, 277—313. Compare Abstr., 1899, ii, 202, 208, 284).—The authors regard the work of Cady (Abstr., 1898, ii, 203) and Goodwin and Thompson (*Phys. Rev.*, 1899, 8, 38) as being of a merely qualitative nature, and accordingly describe a complicated apparatus in which liquid ammonia can be purified, and isolated for a length of time. Numerous compounds have been used as solutes, and the conductivity of the resulting solutions has been determined by Kohlrausch's method. The molecular conductivity at infinite dilution for solutions of binary salts in ammonia at -38° ranges from 290—340 Kohlrausch units; a much greater value than that for the corresponding aqueous solutions at 18°, probably owing to the greater ionic velocities in ammonia solutions. The dissociation of binary salts, however, is, as a rule, less than in aqueous solutions, and Ostwald's dilution law holds approximately for solutions of these salts in ammonia. Silver iodide is dissociated in ammonia, although to a less extent than other binary salts; mercuric cyanide and silver cyanide both give conducting solutions, but the molecular conductivity of the former falls slightly, that of the latter rises slightly, with dilution. The only ternary salt fully examined, strontium nitrate, has a high molecular conductivity, and, as in aqueous solution, it approaches its maximum more slowly than the binary salts. Many nitro-compounds are good conductors when dissolved in ammonia; so are generally acid and basic amides. These latter are regarded as acids and bases, derived from ammonia in the same way as oxygen acids and bases are derived from water; this analogy is borne out by the chemical behaviour of ammonia solutions of the amides and by their action on indicators. In agreement with Cady, the authors find that ammonia solutions of the alkali metals conduct electricity without polarisation at the electrodes. The molecular conductivity of these solutions changes but slightly with the concentration; the temperature coefficient is positive.

J. C. P.

Electrolysis of Sodium Chloride. By C. G. L. WOLF (*J. Physical Chem.*, 1900, 4, 200—206).—The author describes a form of U-tube, fitted with a stirrer, which he used for the electrolysis of sodium chloride and the examinations of the gases liberated at each electrode. The solution of sodium chloride contained about 300 grams per litre, with 1.8 grams of potassium chromate added, and the current employed was about 1 ampère. The percentage inefficiency

at the cathode was but slight, being seldom over 1 per cent.; but at the anode it varied more, being usually about 20 per cent., and during the experiment of 7.4 ampère hours, 12.7 per cent. of the sodium chloride had been oxidised to chlorate. It was found that variations of temperature had a great effect on the efficiency, and that efficient stirring is necessary.

L. M. J.

Application of Faraday's Law to the Electrolysis of Fused Salts. By A. HELFENSTEIN (*Zeit. anorg. Chem.*, 1900, 23, 255—316. Compare Lorenz, this vol., ii, 333).—The author has electrolysed the chlorides of lead, zinc, tin, cadmium, and silver, and lead bromide and iodide, and has studied the influence of varying conditions on the current yield. Neither in a V-tube, nor in any simple apparatus which allows direct contact of the anode and cathode liquids, can a decomposition be effected equal to that required by Faraday's law. Rise of temperature, decrease of current strength, decrease of the distance between the electrodes, and prolongation of the electrolysis have the effect of diminishing the current yield; in the case of lead iodide, however, the yield increases for a certain interval, 600—800°, with rise of temperature, probably owing to the formation of periodide. The chief cause of the imperfect yields obtained is the solubility of the metal in its fused halogen compounds, and a consequent diffusion to the anode and to the surface of the electrolyte, where the metal is oxidised or goes off as vapour. Special experiments, in which a regulus of the metal was kept in contact with its fused halogen compound, showed that the solubility and rate of diffusion increase with rise of temperature. The diffusion of the halogen from the anode, although of less account than the diffusion of the metal from the cathode, is also responsible for a diminution of the yield; this influence of the halogen increases from chlorine to iodine.

An approximately theoretical yield is obtained when the disturbing factors enumerated above are removed. The anode and cathode are separated from each other, either by being enclosed in tubes with lateral openings, or by the interposition of a diaphragm. As is to be expected, the enclosing of the cathode is much more essential than the enclosing of the anode. Further, the electrolyte is allowed to solidify on the surface, so as to prevent diffusion of metallic vapour into the atmosphere, and the temperature is kept as low as possible—just above the melting point of the salt. With these precautions, a yield is obtained which is independent of temperature, current strength, and duration of the experiment.

J. C. P.

Electrolytic Conductivity of Saturated Solutions. By HARRY M. DAWSON and P. WILLIAMS (*Zeit. Elektrochem.*, 1899, 6, 141).—Apparatus is described in which the saturated solution may be filtered and transferred to the vessel in which the conductivity is to be measured without change of temperature and without exposure to the air.

The conductivity of supersaturated solutions of some readily soluble salts, such as magnesium sulphate, potassium carbonate, calcium chloride, decreases as the concentration increases. In the

case of salts having a transition point, this may be determined by making a series of determinations of the conductivities of solutions saturated at different temperatures. When the results are plotted in a diagram, curves are obtained which intersect at the transition temperature. The method is especially applicable to salts which are not readily soluble in water. The transition temperature of the hydrates of thorium sulphate, $\text{Th}(\text{SO}_4)_2 \cdot 9\text{H}_2\text{O}$ and $\text{Th}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$, was found in this way to be 48° . Determinations with the dilatometer and tensimeter gave respectively 46.5° and 47.8° .

T. E.

Reducing Action of Electrolytically Deposited Metals. By A. BINZ and A. HAGENBACH (*Zeit. Elektrochem.*, 1899, 6, 261—271).—When indigotin is suspended (a) in a solution of sodium hydroxide, (b) in a solution of zinc oxide in sodium hydroxide, and the two liquids are placed in the cathode compartments of two electrolytic cells with zinc cathodes through which the same current is passed, then the indigotin in solution (b) is more rapidly reduced than that in solution (a). The deposition of zinc at the cathode would thus appear to exercise a more vigorous reducing action than the evolution of hydrogen. Indigotin is not a very suitable substance, however, since it is insoluble in the liquids used. Subsequent experiments were made with solutions of diamine-pure-blue, Ponceau R, and patent blue N. The influence of the cathode metal was first investigated. The solution was placed in the cathode compartments of two cells which differed only in the nature of the cathode metal, and through which the same current was passed. The colouring matters were dissolved in solutions of potassium hydroxide or of potassium or sodium acetate. The metals used were copper, platinum, zinc, and mercury, and in the case of the latter no amalgam was formed, the alkali metal being redissolved as fast as it separated. Practically no difference was found in the rate of reduction with the different cathodes. By using a concentrated solution of pure potassium hydroxide, an amalgam of potassium is obtained at a mercury cathode which is acted on very slowly by the solution. With a dilute solution of potassium hydroxide, the potassium is dissolved out of the amalgam much more rapidly. By using a concentrated and a dilute solution of potassium hydroxide, it is therefore possible to have evolution of hydrogen in one cell, and formation of amalgam in another. In this way, it is shown that, when hydrogen is evolved, the reduction of the colouring matters takes place very much more slowly than when an amalgam is produced. These experiments point to the alkali metal being the real reducing agent, and not the hydrogen liberated by the action of the metal on water. To test this further, zinc is caused to separate at a mercury cathode from a saturated solution of zinc oxide in sodium hydroxide in one cell, and hydrogen to separate from a solution of sodium hydroxide at a copper electrode in the other, both cells containing the same colouring matter. No hydrogen is evolved by the contact of the zinc amalgam with the solution, so that any reduction which occurs must be due to zinc. As a matter of fact, it is found that the reduction always takes place more rapidly in the cell with the zinc than in that in which the equivalent quantity of hydrogen is liberated. The

authors conclude that many cases of supposed reduction by nascent hydrogen are really cases of direct reduction by a metal. T. E.

Theory of Solution Pressure. By S. ROSLINGTON MILNER (*Phil. Mag.*, 1900, [v], 49, 417—423).—The author regards the proof given by Nernst for the expression representing the difference of potential between a metal and the solution of an electrolyte containing the metal in the ion state to be unsatisfactory, as the possibility of actually carrying out the individual process of the cycle is not apparent. He therefore deduces similar expressions by a slightly different method of consideration which is free from these objections. When the value of the solution pressure is excessively large, as in the case of zinc (10^9 atmos.), the author considers it to be due to the inapplicability of the gas laws over such a great range of pressure, and in this case P is merely a constant, such that $RT \log P$ represents the value of $\int v dp$ of the ions between unit pressure and the actual solution pressure. L. M. J.

Determination of some Coefficients of Magnetic Susceptibility. By STEFAN MEYER (*Ann. Phys.*, 1900, [iv], 1, 664—667. Compare this vol., ii, 7).—The magnetic susceptibility of solutions of vanadium chloride is independent of the dissociation, and the molecular susceptibility of this compound is found to be 1.25×10^{-6} . This value stands in a simple relation to those obtained for the iron group [$V : Ni : Cr : Fe : Co : Fe : Mn = \frac{1}{2} : 2 : 2\frac{1}{2} : 3 : 4 : 5 : 6$].

A higher value is found for the susceptibility of gadolinium oxide than that previously obtained; it is supposed, on the ground of spectroscopic investigation, that the old preparation contained more or less of a strongly magnetic element. From samarium sulphate, a value is found for the atomic susceptibility agreeing well with earlier determinations. J. C. P.

Atomic and Molecular Magnetism. By STEFAN MEYER (*Ann. Phys.*, 1900, [iv], 1, 668—672. Compare this vol., ii, 7).—The results previously recorded are supplemented by an investigation of the magnetic susceptibility of copper compounds. The fundamental difference in the magnetic behaviour of cupric and cuprous salts, suggested by Wiedemann, is not borne out by the experiments; cupric and cuprous sulphides are about equally diamagnetic.

The molecular volume and molecular magnetism are compared with the sum of the atomic volumes and atomic magnetisms respectively, and it is seen that when contraction takes place in the formation of the compound, the molecular magnetism is increased; when an increase of volume takes place, the diamagnetic character becomes more marked. Hence it is permissible to calculate the atomic magnetism of an element from the molecular magnetism of its compounds only when the molecular volume of the compound is equal to the sum of the atomic volumes.

The author points out the advantages of his method of determining magnetic susceptibility over that of du Bois and Liebknecht (this vol., ii, 127). J. C. P.

Deduction of Reaction Isotherms and Isochors for Systems involving Dissociation. By KIKUNAYE IKEDA (*Zeit. physikal. Chem.*, 1900, 33, 287—294).—A theoretical paper, not suitable for abstraction.

J. C. P.

Overflowing Thermocalorimeter. By GUSTAVE MASSOL (*Compt. rend.*, 1900, 130, 1126—1128).—Regnault's thermocalorimeter can only be used for small ranges of temperature below 40—50°. The instrument may be employed at temperatures of 250° and 300° if concentrated sulphuric acid is employed as the expanding liquid instead of alcohol; it also becomes possible to work through considerable ranges of temperature by adopting an overflow principle as in Walferdin's maximum weight thermometer. By means of this form of thermocalorimeter, the author has determined the specific heats of salt solutions at temperatures near their boiling and freezing points.

G. T. M.

Critical Temperatures of some Organic Sulphur Compounds. By L. FERRETTO (*Gazzetta*, 1900, 30, i, 296—302).—Using Altschul's method and apparatus (Abstr., 1893, ii, 446), the author has determined the following critical temperatures: ethyl mercaptan, 228°; methyl sulphide, 231·2°; ethyl sulphide, 284·67°; methyl ethyl sulphide, 259·66°; isoamyl mercaptan, 334° (?). The following compounds show decomposition below their critical temperatures, which were hence determined in ethereal solution, Pawlewski's formula for mixtures being employed: isoamyl mercaptan, 320·92°; isoamyl sulphide, 391·25°; allyl sulphide, 380·38°; ethyl disulphide, 368·93°. The following are the differences between the critical temperatures and the boiling points at ordinary pressures: ethyl mercaptan, 191·8°; methyl sulphide, 193·9°; ethyl sulphide, 191·77°; ethyl methyl sulphide, 193·76°; isoamyl mercaptan, 200·92°; isoamyl sulphide, 176·25°; allyl sulphide, 241·0°; ethyl disulphide, 216·13°. Thus Pawlewski's law, that for comparable substances there is a constant difference between the critical temperature and the boiling point, holds well amongst the first group of four of the above compounds, whilst for isoamyl mercaptan and isoamyl sulphide, the critical temperatures of which were determined in ether, the agreement with the law is less good. Guldberg's law of the constancy of the ratio between the absolute critical and boiling points is obeyed well by all the above compounds except isoamyl sulphide, the value for which, 1·38, differs considerably from Guldberg's number (1·55). The difference between the critical temperatures of two homologous compounds of the above series is roughly proportional to the difference in composition. The following table shows the differences between the critical temperatures of these sulphur derivatives and those of the corresponding oxygen compounds:

				Difference.
EtSH	228°	EtOH	244°	— 16
C ₅ H ₁₁ ·SH	320·92	C ₅ H ₁₁ ·OH	306·6	— 14·32
SMe ₂	231·2	Me ₂ O	129·6	+ 101·6
SEt ₂	284·67	Et ₂ O	191	+ 93·67
SMeEt	259·66	OMeEt	167·7	+ 91·96
S ₂ Et ₂	372·76	Et ₂ O ₂	191	+ 181·76

Thus in the ethers, the substitution of an atom of sulphur for one of oxygen raises the critical temperature by about 90° to 100° , whilst with the alcohols, the difference is much smaller and in the opposite direction.

T. H. P.

Heats of Combustion and Formation of Iodine Compounds. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1900, 130, 1094—1101).—Iodine compounds are completely burnt in the calorimetric bomb by the use of compressed oxygen and a priming of gun-cotton, the whole of the halogen being liberated. The following thermochemical constants are recorded :

	Molecular heat of combustion.		Molecular heat of formation.
	Constant vol.	Constant pressure.	
Methyl iodide.....	196.1 Cal.	196.5 Cal.	+ 1.3 Cal.
Methylene „	178.1	178.4	- 14.9
Iodoform	161.8	161.9	- 33.1
Ethyl iodide	355.4	356.0	- 24.0
<i>n</i> -Propyl „	512.3	514.3	+ 10.2
<i>iso</i> -Propyl „	507.4	509.1	+ 15.0
Allyl „	476.85	478.33	- 22.9
Iodobenzene	770.0	770.7	- 32.3
<i>o</i> -Iodobenzoic acid	769.4	769.6	+ 63.1
<i>o</i> -Iodosalicylic „	706.5	706.4	+ 126.3
Diiodosalicylic „	700.2	699.9	+ 98.3
Ethylene iodide.....	324.3	324.9	+ 1.7
Tetrioethylene	261.6	261.6	- 73.0
Iodopyrrole (iodole), C_4HNI_4 ...	503.3	503.1	- 91.4

The substitution of solid iodine for gaseous hydrogen in methane is always attended by an absorption of heat, the values for the introduction of successive atoms of the halogen being -17.6 , -17.0 , and -18.2 Cal. The difference between the heats of formation of allyl and propyl iodides has the same value as that for the corresponding alcohols, namely, -33.1 Cal. The heat absorbed by the substitution of iodine for hydrogen in benzene is -28.2 Cal., whilst in the case of benzoic acid it is -31.1 Cal. The introduction of the first atom of iodine into salicylic acid is accompanied by a thermal change of -12.5 Cal., whilst that of the second produces an absorption of -28.0 Cal. These results explain the non-formation of aromatic iodo-derivatives by direct substitution. The addition of iodine (1 mol.) to ethylene produces a heat change of 16.3 Cal., whilst the substitution of the four hydrogen atoms of this olefine by iodine is accompanied by an absorption of heat, namely, -58.4 Cal. The thermal effect of introducing four iodine atoms into the pyrrole ring is -73.4 Cal.

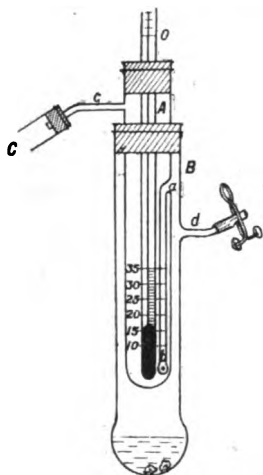
G. T. M.

Apparatus for determining Molecular Weights by the Boiling Point Method. By HERBERT N. MCCOY (*Amer. Chem. J.*, 23, 353—360).—In applying Walker and Lumsden's modification of Landsberger's method (see *Abstr.*, 1898, ii, 283 ; *Trans.*, 1898, 73, 502),

the author has combined the functions of the jacket and the boiling flask, as shown in the accompanying sketch.

Suitable quantities of the pure solvent are introduced into the outer tube, *B*, and the inner tube, *A*. The solvent in *B* is boiled, and if the side tube, *d*, be closed, the vapour passes through the tube *a*, which has five small perforations at its lower extremity, *b*, into the solvent in *A*. The latter is thus raised to its boiling point, and the excess vapour passes through the tube *c* to a Liebig's condenser. When the constant temperature of the boiling solvent has been ascertained, the side tube, *d*, is opened, and the boiling interrupted until a weighed quantity of the solute has been introduced into the inner tube; as in Walker and Lumsden's apparatus, the inner tube is graduated, so that the volume of the solution can be read off. Test experiments, in which various substances were dissolved in alcohol, benzene, ether, or water, gave very satisfactory results.

J. C. P.



A Manostat. By A. SMITS (*Zeit. physikal. Chem.*, 1900, 33, 39—46).—An apparatus has been devised to secure a steady pressure during boiling point experiments, the deviations not exceeding 1 mm. of

water. The space in which the pressure is to be kept constant is connected (1) with the shorter limb of a mercury manometer, (2) with a suction pump. If the latter is working to begin with, then the mercury in the shorter limb of the manometer rises, and at a certain point touches a copper rod, thereby completing a circuit containing an electromagnet; the first circuit is so combined with a second circuit with a second electromagnet that the suction pump is shut off, and is connected again only when the mercury has fallen below the point of the copper rod. The pressure in such an apparatus increases very slightly with a rise of the external temperature, and is independent of the variations of the atmospheric pressure.

J. C. P.

Disturbing Influences at the Critical Point of Pure Liquids and Mixtures. By RUDOLF VON HIRSCH (*Ann. Phys.*, 1900, [iv], 1, 655—663).—The influence of gravity on the critical phenomena is discussed. It is also pointed out that the appearance or disappearance of the meniscus lags behind the temperature, and experiments with ether show that the extent of this lag depends very much on the rate of change of temperature. As the mean of a number of determinations with different tubes, 194.7° is given as the critical temperature of ether.

The author considers that the above influences are sufficient to account for many of the anomalies observed at the critical point, and that there is no need to replace van der Waals' theory by newer ones.

J. C. P.

Determination of the Decrease in the Vapour Tension of Solutions by means of the determination of the Increase in the Boiling Point. By A. SMITS (*Proc. K. Akad. Wetensch. Amsterdam*, 1900, 2, 469—477).—The boiling vessels used were made of silver, and could be connected with the manostat devised by the author (see this vol., ii, 388). Enamel grains and silver tetrahedra were employed to induce regular boiling, and the condensed vapour flowed back through a tube with outlets turned away from the thermometer. With a steady pressure, the boiling point of water remained constant to 0.002° ; but it was noticed that a 1 cm. vertical displacement of the thermometer caused a difference of 0.01 — 0.03° in its indications.

Two such silver vessels, *A* and *B*, containing distilled water, were connected with the manostat, and the temperature of boiling recorded. A weighed quantity of solute was introduced into *A*, and the pressure was adjusted so that the boiling point of the solution was the same as that of the pure water under the original pressure. The thermometer immersed in the boiling water in *B* had now fallen, and the difference between the readings of the two thermometers corresponded with the decrease of vapour tension due to the dissolved substance. The results of the investigation are to be communicated later. J. C. P.

Theory of Vapour Pressure. By R. GAHL (*Zeit. physikal. Chem.*, 1900, 33, 178—214).—A method is described for the measurement of the partial pressures of electrolytes dissolved in water, and especially applicable to very small pressures; it consists essentially in the aspiration of a known volume of air through (1) the solution and (2) a flask of perfectly pure water, the partial pressure being estimated from the increase of conductivity of the water in this flask. As is evident, many precautions are necessary to ensure accuracy with a method of this nature, and of these a full account is given. The author investigates theoretically, from the thermodynamical basis, the relations between partial pressure and cryoscopic depression, and calculates the former, in the case of hydrogen chloride, from Roloff's freezing point determinations (*Abstr.*, 1896, ii, 291). The values so obtained are compared with direct determinations by the above method, the agreement being satisfactory, as, for example, 6.74 per cent. acid, found 0.0094 mm. mercury, calc. 0.0094 ; 3.5 per cent., found 0.00117 mm., calc. 0.00116 . From the values of the partial pressure of hydrochloric acid, the decomposition tension in salts of organic bases may be determined in the case of the insoluble salts of insoluble bases by finding the strength of the acid with which the salt is in equilibrium. If a solution of ammonium chloride be boiled, owing to dissociation and the greater partial pressure of ammonia, the distillate is alkaline and the residue acid, but the author finds that air passed over solid ammonium chloride causes no increase of conductivity in the water; the salt is hence not dissociated, and possesses but a very small vapour pressure. Equations similar to those previously deduced also hold for mixtures of two or three components, and the author discusses the cases of sulphuric acid hydrates and of hydrated crystals. The partial

pressure of sulphuric acid in solution could not be determined by this method, however, owing to the fact that the acid sufficiently concentrated to give a measurable pressure showed also a partial dissociation with formation of sulphur dioxide.

L. M. J.

Liquefaction of Gaseous Mixtures of Carbon Dioxide and Sulphur Dioxide. By F. CAUBET (*Compt. rend.*, 1900, 130, 828—829).—The experiments previously recorded (this vol., ii, 191) are extended to mixtures of carbon dioxide and sulphur dioxide, eight different mixtures being examined, and the critical line obtained. Retrograde condensation is obtained at all compositions, and, for the most favourable mixtures, is observed between wide limits of temperature and pressure, namely, 7° and 30 atmos., whilst the ratio of the maximum volume of the liquid to the total volume is also great, reaching 0.2.

L. M. J.

Relative Rates of Effusion of Argon, Helium, and some other Gases. By FREDERICK G. DONNAN (*Phil. Mag.*, 1900, [v], 49, 423—446).—The rate of effusion, that is, efflux through a small hole in a thin-walled partition, is theoretically considered; assuming that viscosity effects are eliminated, that the ideal gas laws hold, that the efflux is adiabatic, and that the motion is steady, the rates of effusion of two gases are still not simply proportional to the square roots of the densities, but are also dependent on the ratios of the two specific heats for the two gases. Considerable difficulty was experienced in obtaining apertures for which the viscosity effect was negligible, and a correction for viscosity is given, but is in most cases very small. The results show that, when compared with oxygen, the rate of effusion of argon is $3\frac{1}{2}$ per cent. faster than that calculated merely from the densities, and this is in qualitative accord with the theoretical deduction, or may be regarded as an additional proof of a high specific heat ratio. Hydrogen, oxygen, and carbon monoxide have rates of effusion in accord with those calculated, the specific heat ratios being also approximately equal for these gases; the effusion of carbon dioxide is, however, about 1 per cent. faster than that calculated from the density, and this is not ascribable to a high specific heat ratio. With helium, a relatively large viscosity correction has to be introduced, but the results are still not in accord with theory, the rate being slower than that calculated from the density. The author hence concludes that some factor has been omitted in the theoretical consideration, and that this is probably to be found in the Joule-Thomson effect. It is shown that a gas will effuse more slowly or more rapidly than an ideal gas, according as the Joule-Thomson effect is negative or positive. As for all the gases which Joule and Thomson examined, the constant was positive except for hydrogen, where the sign is uncertain, and as helium is even more "perfect" than hydrogen, it is probable that the sign is here negative, and that the anomalies of effusion are hence explicable.

L. M. J.

Dissociation in Dilute Solutions at 0°. By W. C. DAMPIER WHETHAM (*Proc. Roy. Soc.*, 1900, 66, 192—203).—The degree of dissociation in dilute solutions, as determined by the conductivity at

18° or 25°, is not directly comparable with the value arrived at from freezing point experiments. The author has accordingly measured the conductivity at 0° of solutions of sulphuric acid, potassium chloride, barium chloride, copper sulphate, potassium permanganate, potassium ferricyanide, and potassium dichromate. The results are contained in a number of tables, and curves are drawn showing how α , the degree of dissociation, varies with the concentration. At 0°, α falls less rapidly with increasing concentration than at higher temperatures. The curve for sulphuric acid shows a maximum, in agreement with other observations at higher temperatures. The curve for potassium permanganate likewise shows a fall in the value of α for the most dilute solutions; this the author attributes to the action of the salt on the impurities left in the solvent.

It may be noted that the solvent and solutions were not allowed to come in contact with anything except platinum. J. C. P.

Relation of Taste of Acids to their Degree of Dissociation.

II. By THEODORE W. RICHARDS (*J. Physical Chem.*, 1900, 4, 207—211).—Owing to the fact that the sour taste of acid salts is stronger than would be expected from the concentration of the hydrogen ions, Kahlenberg considered the explanation of the sour taste from the standpoint of the dissociation theory to be unsatisfactory (this vol., ii, 271). If, however, the sensation of taste is due to a chemical action between the substance and some constituent of the tongue surface, then the sensation may be accompanied by a removal of hydrogen ions, and hence further dissociation would occur in accord with the mass action law. It follows, therefore, that although the order of dissociation is correctly found, yet no quantitative connection can be obtained from the taste, and this is in accord with experiment. The above explanation is also in agreement with the paralysis of the sense of taste by concentrated solutions, and the author points out that hydrogen and hydroxyl ions, which are those possessing the most marked taste (Höber and Kiesow, *Abstr.*, 1899, ii, 206), are also those most capable of causing reactions in substances likely to be present in the tongue. Observed phenomena are hence not opposed to the dissociation theory (compare *Abstr.*, 1898, ii, 209).

L. M. J.

Simple Proof of van't Hoff's Osmotic Pressure Law. By KIKUNAYE IKEDA (*Zeit. physikal. Chem.*, 1900, 33, 280—286).—A siphon barometer tube, whose longer limb is of small bore, has its short wider limb closed by a moistened piece of bladder. The space in the wider limb unoccupied by mercury is filled with some gas, such as nitrogen, which is insoluble in water. When the whole is surrounded by a gas, for example, ammonia, which is soluble in water, the mercury rises in the longer limb owing to the diffusion of ammonia through the bladder, which thus acts as a semipermeable membrane. If A be the gas for which the membrane is permeable, and B the gas for which it is not permeable, it can be shown that the partial pressure (p) of B is independent of the concentration of A ; when this concentration is small, the relation $p = RTC$ holds, and from the above it must also hold when the concentration of A is great: in this way, the law can

be extended to the case of a solution, where A becomes the solvent and B the solute.

From the law $p = RTC$, Henry's law is deduced; the supposition that the absorption coefficient varies with the concentration of the gas is shown to be contrary to thermodynamical laws. J. C. P.

Hardness of Elementary Substances. By JOHANNES R. RYDBERG (*Zeit. physikal. Chem.*, 1900, 33, 353—359).—On the basis of Mohs' scale, and with the help of the existing data, an attempt is made to assign a numerical value for the hardness of the elements. The numbers obtained show that the hardness is a periodic function of the atomic weight. J. C. P.

Limited Chemical Reactions in Homogeneous Systems: Modulus Law. By A. PONSOT (*Compt. rend.*, 1900, 130, 829—832).

A theoretical paper in which the author deduces that in a system in equilibrium, the latter is independent of the pressure or of the presence of foreign substances, that if equilibrium is established at constant pressure, the volume is a minimum, and if at constant volume the pressure is a minimum. Thus the interaction of two salts in solution leads to a minimum volume, and hence at equilibrium $\sum dv/dm = 0$, where dv/dm is the coefficient of volume increase by addition of equivalents of the salts, and from this, as an immediate consequence, follows the additive effect of each radicle in causing change of volume in aqueous solution, and hence also change of density. That is, the coefficient of increase of density by the substitution of one radicle for another is independent of the radicle to which they are combined, and there is thus obtained what is termed the density modulus. Similarly, could be obtained modulus of vapour pressure, osmotic pressure, cryoscopic depression, &c. The author points out that these deductions are established without any presumption of dissociation. L. M. J.

Physical Reactions and the Mass Law. By AZARIAH T. LINCOLN (*J. Physical Chem.*, 1900, 4, 161—187).—Bancroft has shown that the relations between the compounds in certain cases of physical equilibrium may be represented by a modification of the usual mass-action formula, in which the exponential factors are not necessarily integers. Thus the relation between the concentrations x, y of two non-miscible liquids in a third consolute liquid of concentration z may be represented by the equation $x^{\alpha}y^{\beta}/z^{\alpha+\beta} = c$, and in this expression the concentrations may be expressed in units of any nature. If the liquids are mutually soluble, the equilibrium formula becomes $(x - s_2y)^{\alpha}(y - s_1x)^{\beta}/z^{\alpha+\beta} = c$, where s_1 and s_2 are the mutual solubilities (Bancroft, Abstr., 1895, ii, 157). Experimental work has shown that these equations represent the facts with a fair degree of accuracy (Taylor, Abstr., ii, 1898, 66, 213; Bathrick, Abstr., 1897, ii, 135), and the author has examined the system water, benzene, alcohol, using pure compounds and employing great precautions to ensure accuracy in the equilibrium determinations. He finds the results to be in almost perfect accord with those given by the above expression, the differences being far smaller than in previous less accurate experiments and seldom reaching $\frac{1}{2}$ per cent., and he considers that if the

experimental difficulties could be more completely overcome, the accord would be still more perfect. Under these circumstances, he holds that the formula is not merely empirical, but represents the facts absolutely, and is hence the expression of an actual natural law.

L. M. J.

Equilibria in the System : Water, Phenol, and *d*-Tartaric or Racemic Acid. By FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1900, 33, 74—77. Compare Abstr., 1899, ii, 739).—The influence of these two acids in raising the critical mixture temperature of water and phenol is equal, and much less than that of sodium chloride (*loc. cit.*). The critical mixture temperature of a water-phenol system containing 40.9 per cent. of tartaric acid (referred to water + tartaric acid) is about 30° higher than that of the water-phenol mixture alone. It appears that the elevation of the critical mixture temperature by a third substance is not only a function of the molecular weight of this substance, but depends also on other factors.

J. C. P.

Equilibria in the System : Water, Phenol, and Acetone. By FRANS A. H. SCHREINEMAKERS (*Zeit. physikal. Chem.*, 1900, 33, 78—98).—Mixtures of water and acetone of known composition were put in glass tubes, and known weights of phenol added; the tubes were closed and the temperatures observed at which the contents became homogeneous. A number of tables are thus obtained, and the corresponding curves drawn, showing how this temperature varies with the composition of the ternary mixture. The results are represented also by means of the triangular system, and the binodal curves are drawn for various temperatures: those for higher temperatures are enclosed by those for lower temperatures, and ultimately shrink to a point corresponding with the temperature 92°, and the composition 59 per cent. of water, 12 per cent. of acetone, and 29 per cent. of phenol. The chief feature of interest is that whilst above 68° separation into two layers takes place in none of the three binary systems water-acetone, water-phenol, and phenol-acetone, yet such a separation can take place up to 92° in mixtures containing all three substances.

The paper contains also a review of the author's experimental work on ternary systems (compare Abstr., 1897, ii, 483; 1898, ii, 329, 424, 564; 1899, ii, 739; this vol., ii, 135).

J. C. P.

The System : Water, Phenol, and Hydrochloric Acid. By W. H. KRUG and FRANK K. CAMERON (*J. Physical Chem.*, 1900, 4, 188—192).—If hydrochloric acid be added to the partially consolute mixture of phenol and water, the temperatures at which solid phenol can exist are altered. Since the system containing the solid phenol and two liquid phases is still monovariant, there is no definite melting point, but if the quantity of water is great compared with that of the phenol, the range of temperatures in which the solid phase persists becomes very small and a freezing point may be obtained. These values were determined for solutions containing from 0 to 130 grams of hydrochloric acid per litre, and a curve for temperatures against acid concentration is given; the temperature in water was found to

be $1\cdot365^{\circ}$, and in the most concentrated solution $17\cdot195^{\circ}$. The author suggests that from this curve the concentration of a hydrochloric acid solution may be quickly determined approximately from the freezing point of phenol in it.

L. M. J.

Velocity of Reaction of Acids in Organic Solvents. By M. GEIGER (*Gazzetta*, 1900, 30, i, 225—233).—The action of methyl alcoholic solutions of various acids on marble has been studied. For solutions of hydrogen chloride, the action is much slower than that of the aqueous acid; the initial velocity of reaction increases with the concentration of the solution, but less rapidly than the latter, so that the ratio of velocity to concentration shows a considerable diminution, owing to the decreasing dissociation of the acid in concentrated solutions. The reaction is greatly influenced by changes of pressure, an increase of 8 cm. of mercury above the atmospheric pressure serving to completely stop the action. Methyl alcoholic solution of hydrogen bromide attacks marble slightly more energetically than the chloride solution does, whilst with hydrogen iodide the reaction is a little slower. The initial velocities with which marble is attacked by these acids and by nitric acid, calculated for 1 c.c. of gas evolved per minute and per sq. cm. of surface, are given in the following table:

	4-Normal.	2-Normal.	Normal.	0·5-Normal.
HCl.....	0·26	0·20	0·16	0·12
HBr	0·31	0·22	0·17	—
HI	—	0·19	0·15	—
HNO ₃	—	0·25	0·14	—

[T] From these values, it is seen that molecular solutions of these acids in methyl alcohol, when not too concentrated, give the same velocity of reaction with marble. Calcium sulphate being insoluble in methyl alcohol, the action of a methyl alcoholic solution of sulphuric acid on malachite was studied, and it was found that no action takes place; the same is the case if blocks of fused sodium carbonate are employed, although hydrogen chloride dissolved in methyl alcohol reacts readily with both these substances. Formic, acetic, and the chloroacetic acids are not dissociated in methyl alcohol solution and, as would hence be expected, do not attack marble or other carbonates. Zinc and magnesium are attacked much more readily than marble by a methyl alcoholic solution of hydrogen chloride.

T. H. P.

[F] **Hydrolysis in Organic Solvents.** By A. CAJOLA and A. CAPPELLINI (*Gazzetta*, 1900, 30, i, 233—240. Compare Gennari, *Abstr.*, 1896, ii, 413).—The velocity with which methyl acetate is hydrolysed by caustic soda or potash, when dissolved in various alcohols, has been measured. The mean hydrolysis constants are given in the following table:

	Propyl alcohol.	isoButyl alcohol.	isoAmyl alcohol
Soda.....	0·004371	0·00941	0·0117
Potash.....	0·004279	0·008285	0·01107

Thus the action is least energetic in propyl alcohol; this confirms the observations of Gennari (*loc. cit.*), who found that sodium hydroxide and

methoxide have a stronger hydrolysing action in ethyl alcohol than in methyl alcohol. In these alcohols, sodium hydroxide acts more energetically than potassium hydroxide. The hydrolysis of methyl acetate by means of methyl alcoholic solutions of sodium, potassium, barium, strontium, ammonium, and tetramethylammonium hydroxides has also been studied. Contrary to what would be expected on the dissociation hypothesis, sodium hydroxide has a hydrolysing effect less energetic than barium or strontium hydroxides. T. H. P.

Energy of Acids Dissolved in Mixtures of Organic Solvents and Water. By ANTONIO MORELLO (*Gazzetta*, 1900, 30, i, 257—284).—The inversion of cane sugar by means of hydrochloric and the chloroacetic acids has been measured in aqueous methyl alcohol (about 86 per cent.) and in aqueous acetone (about 70 per cent.) at the dilution $V=10$. The constants are as follows :

	86 per cent. methyl alcohol.	70 per cent. acetone.
HCl	0.00102	0.00122
$\text{CCl}_3\cdot\text{CO}_2\text{H}$	0.000136	0.000121
$\text{CHCl}_2\cdot\text{CO}_2\text{H}$	0.0000404	0.0000306
$\text{CH}_2\text{Cl}\cdot\text{CO}_2\text{H}$	—	0.00000416

The dissociation constants for hydrochloric and trichloroacetic acids, as deduced from the electrical conductivities, are for the aqueous methyl alcohol, 0.522 and 0.241, and for the aqueous acetone, 0.183 and 0.516 respectively. These results show that trichloroacetic acid, which in acetone is almost completely undissociated, in aqueous acetone suffers dissociation to a greater extent than does hydrochloric acid. Further, the values obtained from the electrical conductivities for hydrochloric and trichloroacetic acids differ both absolutely and relatively from those given by the inversion method. T. H. P.

Hydrolysis of Polysaccharides and Decomposition of Esters; Catalytic Action of some Metals. By OTTO KAR ŠULC (*Zeit. physikal. Chem.*, 1900, 33, 47—56).—Experiments, supplementary to those already described (*Abstr.*, 1897, ii, 136), show that the inversion of sucrose is accelerated by silver, and specially by copper, both in the spongy form. Palladium is found to retard the hydrolysis by dilute acids of sucrose, maltose, and raffinose.

The decomposition of amyl acetate by water is very much slower in the presence of palladium, osmium, rhodium, iridium, copper, and silver; mercury is practically without effect. With isobutyl acetate, qualitatively similar results have been obtained. In view of the difficulty of securing uniform conditions, no attempt has been made to compare quantitatively the catalytic effect of the metals named. J. C. P.

Chemical Dynamics of the Condensation of Acetone. By KARL KOELICHEN (*Zeit. physikal. Chem.*, 1900, 33, 129—177).—In the presence of sodium hydroxide, acetone undergoes condensation with the formation of diacetonolalcohol, and the author shows that this reaction is reversible, and that the final state is an equilibrium between the two products. In solutions, not too concentrated, it is shown that,

in accord with the mass action law, the equilibrium is expressed by the equation $(1-x)v/x^2=k$.

Although the velocity of the reaction is greatly influenced by the concentration of the catalyser, yet this has no effect on the final equilibrium, the velocity in either sense being equally affected. The velocity is approximately proportional to the concentration of the hydroxyl ions, and although for very weak bases the concordance is very imperfect, yet it is sufficient to indicate that the hydroxyl ion is the actual catalyser, and the discrepancies may be ascribed to the effect of the medium on the dissociation of the base, and to secondary reactions. The velocity of the reaction hence affords a means for the determination of the hydrolysis of sodium salts of weak acids, and the values so obtained for sodium carbonate are compared with those found by Shields (Abstr., 1893, ii, 418), with which, however, they are not in good accord, no explanation being given of the discrepancies. Normal salts have a marked action on the velocity, sodium chloride, nitrate, and thiosulphate causing a decrease, sodium sulphate an increase. The effect of temperature was also investigated; at low temperatures, the equilibrium is disturbed with increase of the alcohol. From the values of the equilibrium constants at 25.2° and 0° , the value $-77.4K$ is calculated for the heat of reaction. L. M. J.

Solubility of a Mixture of Salts having one Common Ion. By CHARLES TOUREN (*Compt. rend.*, 1900, 130, 908—911).—The solubility of a salt is diminished by the addition of another containing a similar ion, and in the case of slightly soluble salts, numerous experiments by Noyes with others have proved this diminution to be in accord with that predicted theoretically. The author extends the experimental work to very soluble salts, and has determined the solubility field for potassium nitrate and chloride, and nitrate and bromide. The experiments were made at temperatures of 14.5° and 25.2° , and in each case the results are shown by two curves, the first showing the decrease of solubility of nitrate by addition of the chloride or bromide, the second the decrease of solubility of the chloride or bromide by addition of nitrate; the intersection of these curves gives the composition of the solution in equilibrium with the two solid phases. It is seen that the first of these curves is identical for the two halogen salts, when the concentrations are expressed in molecular quantities, so that the molecules of chloride and bromide have equal effects in lowering the solubility of the nitrate, and are hence, even at high concentrations, equally dissociated. L. M. J.

Mechanism of Gelation in Reversible Colloidal Systems. By W. B. HARDY (*Proc. Roy. Soc.*, 1900, 66, 95—109).—The properties of the ternary system alcohol-gelatin-water have been studied. Below a certain temperature there are two phases, separated by a well-defined surface. The temperature of separation is raised by an increase in the proportion of alcohol or gelatin, and lowered by an increase in the proportion of water. Both phases are at first liquid, but with fall of temperature one becomes solid. The solid solution phase forms on the concave side of the surface of separation when the proportion of gelatin is small, on the convex side when the proportion

of gelatin is large. The more slowly the two phases are established, the less is the surface of separation, both in extent and curvature.

The system agar-water was also studied. A hydrogel of agar consists of a solid and a liquid part; each of these phases is a mixture of agar and water, but their composition depends on the ratio of agar to water in the whole mass, and more especially on the temperature. Taking the gaseous phase also into account, the hydrogel of agar is a system of three phases. The equilibrium is determined by the chemical potential of the components in the various phases, by two pressures and by temperature, other operating variables being capillary tension and the energy of the surface between the fluid and solid phases.

J. C. P.

Nature of so-called Colloidal Metallic Solutions. By RICHARD ZSIGMONDY (*Zeit. physikal. Chem.*, 1900, 33, 63—73).—A criticism of the conclusions of Stoeckl and Vanino (this vol., ii, 11). The author maintains that the gold solutions previously described by him (*Abstr.*, 1898, ii, 522) are really colloidal solutions, and not merely suspensions. The general characteristics of these two classes of liquids are discussed, and the tests applied by Stoeckl and Vanino are regarded as quite inadequate and inconclusive.

J. C. P.

Representation of the Periodic System of the Elements. By KARL SCHIRMEISEN (*Zeit. physikal. Chem.*, 1900, 33, 223—236).—The elements are represented in a system of circles, the angular displacement, in a clockwise direction, from the highest point of the circle, being proportional to the excess of the atomic weight above the initial value. The first circle embraces values from 3.96 (helium) to 20, so that lithium is situated at 68.8°, fluorine at 337.7°, &c.; the second circle is from 20 to 37.1; the third and fourth form a figure of eight, the upper circle embracing values between 37.1 and 48.3 and 72.7 and 83.9, the lower values between 48.3 and 72.7. A similar double set occurs for the fifth and sixth groups, 83.9 to 131.4, and for the eighth and ninth, 163 to 227, the tenth circle containing only two elements. The properties of elements may be deduced from their positions on these circles, and the author claims that his arrangement gives a better insight into the relations of the elements than any previously published, indicating more clearly the transition of properties of the elements of each group, and the properties of the different elements; that it locates the sub-groups more perfectly, connects coloured ions with the chemical properties, and indicates those places in the Mendeléeff system which it is probable will, or will not, be filled.

L. M. J.

Calibration of Glass Tubes, and some Compressibility Coefficients. By GEORGE A. HULETT (*Zeit. physikal. Chem.*, 1900, 33, 237—244).—The glass tube employed for compressibility determinations was calibrated by filling with mercury, and withdrawing equal quantities by means of a small capillary pipette, the tube being immersed horizontally in a specially constructed thermostat, and the position of the end of the mercury read by a microscope. The accuracy of the calibration was seen by the concordance of the corrected lengths

of a mercury thread in different parts of the tube. The apparent compressibility of mercury in this tube was found to be 0.78 cubic millimetres per c.c. per 100 atmospheres, and, accepting Amagat's value of 0.039 for the absolute compressibility, this leads to the value of 0.39 cubic mm. per c.c. for the expansion of the glass tube per 100 atmospheres, which agrees well with the value 0.40, calculated from the dimensions of the tube. The compressibility of pure distilled water, containing dissolved air, was found to be 0.0453 at 9°, 0.0446 at 17°, and 0.0419 at 50°; and the compressibility of *p*-toluidine at 45° was found to be 0.0512.

L. M. J.

Inorganic Chemistry.

Vapour Density of Bromine at High Temperatures. By EDGAR P. PERMAN and G. A. S. ATKINSON (*Zeit. physikal. Chem.*, 1900, 33, 215—222).—A porcelain flask of about 1 litre capacity was heated in a muffle furnace, exhausted by a pump until the pressure was reduced to about one-sixth of an atmosphere, and then filled with bromine vapour, this process being repeated six times. The bromine vapour was then withdrawn by aid of the pump through absorption tubes, the flask filled with air, and the withdrawal repeated six times, the weight of the bromine being then found. Temperatures were determined by means of a thermo-electric junction calibrated by boiling selenium and melting potassium sulphate. The vapour densities so obtained were: 650°, 80.0; 830°, 79.7; 900°, 78.6; 950°, 77.5; 1015°, 76.7; 1050°, 74.3. At temperatures about 1040°, it was found that the density decreased from 76 at a pressure of 755 mm., to 71.8 at 47.3 mm., and curves are given showing these variations of density with temperature and pressure. The ratio of the velocities of dissociation and association are calculated for temperatures from 800° to 1050°, the ratio increasing over a hundred-fold within this range.

L. M. J.

Preparation of Hydrogen Sulphide and of its Solution. By CLEMENS WINKLER (*Ber.*, 1900, 33, 1040—1043).—The apparatus for the generation of hydrogen sulphide is the same as that previously described (*Zeit. anal. Chem.*, 1882, 21, 386). The gas is first passed through a leaden wash-cylinder, and then into a flat leaden vessel half filled with distilled water. When the water is saturated, a given volume may be withdrawn and replaced by pouring the same amount of distilled water through a funnel attached to the top of the vessel. The apparatus is thus kept filled with a saturated solution of hydrogen sulphide, which, for most qualitative purposes, is better than the gas.

J. J. S.

Combination of Metallic Iodides with Sulphur Dioxide. By E. PÉCHARD (*Compt. rend.*, 1900, 130, 1188—1189).—Sulphur dioxide is absorbed by an aqueous solution of potassium iodide, the

solution turning yellow, and finally orange, but this coloration is not due to free iodine. When sulphur dioxide is passed over solid potassium iodide at 0° , the salt turns yellow, and absorption of the gas readily takes place, with formation of the compound SO_2KI , which, on heating to 100° , readily parts with its sulphur dioxide. The following values (in cm. of mercury) were obtained for the vapour tension of this compound: 60 at 0° , 93 at 10° , 146 at 20° , 238 at 30° .

Similar compounds are formed with sodium, ammonium, barium, calcium, and silver iodides, the compound formed with the last being of a brick-red colour.

Hydriodic acid also readily absorbs sulphur dioxide, giving an orange-yellow solution from which free iodine is absent.

H. R. LE S.

Compounds of Telluric Acid with the Iodates. By RUDOLPH F. WEINLAND and H. PRAUSE (*Ber.*, 1900, 33, 1015—1018). The alkali iodates unite with telluric acid to produce compounds analogous to those formed with sulphuric, chromic, molybdic, and tungstic acids. *Potassium telluriiodate*, $\text{K}_2\text{O}, \text{I}_2\text{O}_5, 2\text{TeO}_3, 6\text{H}_2\text{O}$, crystallises from a concentrated solution of its components in colourless prisms. The *rubidium* salt has a similar composition, whilst the *ammonium* salt has the formula $(\text{NH}_4)_2\text{O}, \text{I}_2\text{O}_5, 2\text{TeO}_3, 8\text{H}_2\text{O}$, and crystallises in irregular, six-sided plates. *Potassium telluridiiodate*, $\text{K}_2\text{O}, \text{I}_2\text{O}_5, \text{TeO}_3, 3\text{H}_2\text{O}$, crystallises from a solution of its components containing very slight excess of potassium hydroxide in vitreous, rhombohedral crystals. When recrystallised from water, a certain amount of the telluriiodate is formed.

It has been found impossible to prepare sodium salts of similar composition. From analogy with the molybdoiodates, it seems probable that the two potassium salts have the constitutional formulæ $\text{KO} \cdot \text{IO}(\text{OH}) \cdot \text{O} \cdot \text{TeO}_2 \cdot \text{OH}$ and $\text{KO} \cdot \text{IO}(\text{OH}) \cdot \text{O} \cdot \text{TeO}_2 \cdot \text{O} \cdot \text{IO}(\text{OH}) \cdot \text{OK}$.

A. H.

Preparation and Properties of so-called Nitrogen Iodide. By FREDERICK D. CHATTAWAY and KENNEDY J. P. ORTON (*Amer. Chem. J.*, 1900, 23, 363—368. See *Proc.*, 1899, 15, 17).

Action of Reducing Agents on Nitrogen Iodide. By FREDERICK D. CHATTAWAY and HENRY P. STEVENS (*Amer. Chem. J.*, 1900, 23, 369—376. See *Proc.*, 1899, 15, 17).

Preparation of Phosphorus Trisulphide. By EDM. SPRINGER (*Chem. Centr.*, 1900, i, 712; from *Pharm. Zeit.*, 45, 164).—The loss due to the burning of the mixture of red phosphorus and sulphur in the preparation of phosphorus trisulphide is avoided by at first only heating a small portion of the mixture in a Hessian crucible until combination takes place, removing the burner and then adding the rest of the mixture in small portions at a time. If the first charge takes fire, it is extinguished by means of sand, and after each subsequent addition the lid is replaced on the crucible. The action takes place quietly, causing only a slight puff and formation of fume.

E. W. W.

Electrolysis of Solutions of Alkali Chlorides. By HEINRICH WOHLWILL (*Zeit. Elektrochem.*, 1899, 6, 227). By FRITZ FOERSTER (*ibid.*, 253).—A criticism of Foerster's results relating to the electrolytic formation of chlorates (*Abstr.*, 1899, 88, 278; this vol., ii, 72) and a reply thereto. T. E.

Decomposition of Sodium Thiosulphate by Acids. By HELMUTH VON OETTINGEN (*Zeit. physikal. Chem.*, 1900, 33, 1—38).—According to the ionic theory, the decomposition is represented by the equation $\text{S}_2\text{O}_3 + \text{H}^+ = \text{HSO}_3 + \text{S}$, so that the concentration (x) of the hydrogen ions should have an influence on the progress of the reaction. If y be the time that elapses between the acidification of a dilute sodium thiosulphate solution and the appearance of turbidity, experiments show that for hydrochloric acid $y = 1/[A \log. (1 + bx)]$, where A and b are constants. When, instead of hydrochloric acid, solutions of oxalic, dichloroacetic, or trichloroacetic acid, with an equal concentration of hydrogen ions, are employed, the value of y remains unchanged. This result is regarded as a confirmation of the electrolytic dissociation theory. The initial presence of sodium sulphite hinders the appearance of turbidity, but in this case also the above logarithmic equation is found to be satisfied, provided allowance be made for the appropriation of H^+ ions by the SO_3^- ions, to form either HSO_3 ions or undissociated molecules of sulphurous acid. The point of equilibrium of the reversible reaction—thiosulphate=sulphite+sulphur—cannot be determined, owing to the interaction of thio-sulphate and sulphite (Colefax, *Trans.*, 1892, 61, 176).

Conductivity experiments show that not only in the appearance of turbidity, but also in the further progress of the reaction, the concentration of the hydrogen ions is the determining factor; isohydric acid solutions have an equal effect on the velocity of decomposition.

J. C. P.

Solubility of Sodium Tungstate in Water and the Density and Refractive Indices of its Solutions. By BRONISLAW PAWLEWSKI (*Ber.*, 1900, 33, 1223—1224).—A table is given of densities and refractive indices at 20° of solutions containing from 2.21—38.43 per cent. of sodium tungstate, Na_2WO_4 (corresponding with a range of 2.48—43.14 per cent. of $\text{Na}_2\text{WO}_4 + 2\text{H}_2\text{O}$). W. A. D.

Change of Volume accompanying Fusion of Rubidium. By MORITZ ECKARDT (*Ann. Phys.*, 1900, [iv], 1, 790—792).—By means of a dilatometer, the increase of volume on fusion was found to be 0.01657 c.c. for 1 gram of rubidium. The melting point was 37.8°, and 5 to 6 grams were used in the experiments. The corresponding increase of volume for caesium is 0.01393 c.c. for 1 gram of the metal.

J. C. P.

Electrolysis of the Bromides of the Alkaline Earth Metals. By JON SARGHEL (*Zeit. Elektrochem.*, 1899, 6, 149 and 173).—Solutions of the bromides of calcium, magnesium, and barium (10 and 20 per cent.) are electrolysed in a cell with platinum electrodes, and without

a diaphragm. The influence of temperature, current density, and the addition of alkalis to the solutions is investigated.

Calcium Bromide.—In neutral solutions, bromate and small quantities of hypobromite are formed. The highest current efficiency (90·8 per cent. of the theoretical amount) was obtained with a 10 per cent. solution at 75°; the electrodes were of equal size, and the current density 0·07 ampère per sq. cm. About 3 per cent. of the active bromine was present as hypobromite, the remainder as bromate. At higher temperatures, the yield is considerably smaller; at lower temperatures, it is slightly smaller. Increased concentration and increased current density both diminish the current efficiency. When lime is added to the solution, the efficiency also falls, owing to the increased formation of hypobromite and its subsequent reduction at the cathode. If a cathode with a smooth surface is used (instead of one with a rough surface), the calcium hydroxide, instead of adhering to the metal, passes into the solution, giving rise to the formation of hypobromite, and a consequent diminution of efficiency.

Magnesium Bromide.—More hypobromite and less bromate are formed when solutions of magnesium bromide are electrolysed than is the case with CaBr_2 . The total current efficiency is also less since, owing to the smaller solubility of magnesia, a considerable quantity of bromine escapes conversion into hypobromite. The best result (89·1 per cent. of the theoretical amount) was obtained with a 10 per cent. solution, current density at the cathode 0·07 ampère per sq. cm., at the anode 0·007 ampère per sq. cm., temperature 50°, E.M.F. 5·5 to 12·5 volts. In this experiment, 10·7 per cent. of the active bromine was present as hypobromite; the remainder as bromate. The influence of temperature is the same as in the case of calcium bromide. The efficiency is improved by an increase of the current density or by adding small quantities of magnesia to the solution.

Barium Bromide.—Owing to the ready solubility of barium hydroxide, considerable quantities of hypobromite are formed, and owing to the ease with which this substance is again reduced at the cathode, the total current efficiency is low.

T. E.

Hydrated Calcium Peroxides. By ROBERT DE FORCAND (*Compt. rend.*, 1900, 130, 1308—1311. Compare this vol., ii, 129, 277, 344).—Hydrated calcium peroxides are precipitated on adding hydrogen peroxide to saturated solutions of calcium hydroxide, just as in the preparation of the corresponding strontium and barium compounds.

When hydrogen peroxide ($\frac{1}{2}$ mol.) reacts with calcium hydroxide (1 mol.) in dilute solutions, the heat developed is 6·877 Cal.; the product is a fine, light powder which, when dried on porous plates, gives numbers corresponding with $\text{CaO}_{1\cdot842}\cdot 2\cdot 31\text{H}_2\text{O}$; it differs from the strontium and barium compounds both in composition and in heat of formation. A similar result is obtained when 1 or 2 mols. of hydrogen peroxide are employed. When 3 or 4 mols. of this reagent are added at 13—14°, the compound $\text{CaO}_{2\cdot06}\cdot 8\cdot 57\text{H}_2\text{O}$ is obtained, the heat of formation being 24·666 Cal.; this product is therefore an analogue of the hydrated strontium and barium peroxides, which have a similar

heat of formation and contain approximately the same amount of water; at 20° , the reaction takes a slightly different course, the substance produced being more pulverulent, and having the following composition, $\text{CaO}_{1.91}, 2\text{H}_2\text{O}$. G. T. M.

Radio-active Barium. By BÉLA VON LENGYEL (*Ber.*, 1900, 33, 1237—1240).—Uranium nitrate was fused with 2—3 per cent. of barium nitrate, subsequently converted by heat into the oxide, and the latter fused in an electric arc; the mass was then dissolved in nitric acid, most of the barium nitrate allowed to separate, and the decanted clear solution precipitated with sulphuric acid. The barium sulphate so obtained was strongly radio-active, and this was also the case with the barium carbonate and chloride obtained therefrom. In the author's opinion, this "synthesis" of radio-active substances, although merely preliminary, renders the existence of radium and polonium doubtful (compare P. and S. Curie, this vol., ii, 81—83, 126, 254). W. A. D.

Action of Chlorine on Cupric Hydroxide suspended in Potassium Hydroxide. By F. MAWBOW (*Zeit. anorg. Chem.*, 1900, 23, 233—235).—Hydrated cupric oxide, $6\text{CuO}, \text{H}_2\text{O}$, is obtained by the action of chlorine on cupric hydroxide suspended in potassium hydroxide. The product is a dark brown powder, and a complete conversion of the cupric hydroxide is only obtained by employing a large amount of potassium hydroxide, an excess of chlorine, and heating the mixture at 50 — 60° . No indication was observed of the formation of the red solution described by Krüger (*Zeit. anorg. Chem.*, 2, 658), which is supposed to contain a salt of cupric acid.

E. C. R.

Lead Selenides and Chloroselenides. By HENRI FONZES-DIACON (*Compt. rend.*, 1900, 130, 1131—1133).—Crystalline lead selenide, PbSe , was first obtained by Margottet, who prepared it by heating the amorphous compound in a current of hydrogen. It may also be produced by the following methods: (1) reduction of lead selenate by hydrogen at a bright red heat; (2) reduction of the selenate by carbon in the electric furnace; (3) action of hydrogen selenide on the vapour of lead chloride. The compound crystallises in cubes or in needles composed of rectangular lamellæ, is easily friable, and has a sp. gr. 8.10 at 15° . The selenide is decomposed by heated hydrogen chloride, oxygen, chlorine, steam, and the vapour of phosphorus trichloride. It is readily attacked by nitric and sulphuric acids, but only slowly decomposed by concentrated hydrochloric acid.

Lead chloroselenide, produced by the action of hydrogen selenide on a solution of lead acetate containing hydrochloric acid, is obtained as a red precipitate; it may also be prepared by passing the vapour of phosphorus trichloride over gently warmed amorphous lead selenide. This substance is converted into the selenide by the action of heat, boiling water, hydrogen selenide, sodium thiosulphate, and concentrated solutions of potassium hydroxide. G. T. M.

Formation and Transformation of the Double Salts of Thallium and Silver Nitrates. By C. VAN EIJK (*Proc. K. Akad. Wetensch. Amsterdam*, 1900, 2, 480—484).—Fused mixtures of thallium and silver nitrates were examined in order to ascertain whether a double salt separates out on cooling. Although such a substance was not isolated, yet the melting point determinations showed that, when fused mixtures containing 47—53 per cent. of silver nitrate were cooled down to 80—85°, a double salt separates out, the separation being most rapid at 82·8°. The discontinuity in the melting point curve corresponding with the formation of the double salt, is represented by a horizontal line connecting the portion of the curve representing the separation of solid thallium nitrate from that indicating the crystallisation of the silver salt.

Silver and thallium nitrates are rhombic at the ordinary temperature, but, at 159° and 142° respectively, undergo a structural change and become rhombohedral; if the crystals of either contain any impurity, the transition temperature is either raised or depressed, and this phenomenon is utilised in testing the purity of the solid separating from the fused mixtures of the two salts. Crystals taken from mixtures containing excess of silver nitrate undergo transformation at 160°, and appear to contain 80—100 per cent. of the silver salt; the solid separating from mixtures containing excess of thallium nitrate is transformed at 142°, and is therefore pure thallium salt.

It follows from this that mixed crystals are scarcely formed at all, and that the solidified mixtures are conglomerates of the double salt with excess of silver nitrate or thallium nitrate. At 26—27°, the double salt undergoes a transformation, the precise nature of which is not understood; this change proceeds very slowly, and is detected by dilatometric experiments; the volume of the admixed substance greatly diminishes, whilst that of the admixed silver or thallium salt remains unaltered.

G. T. M.

The Cerite Earths. By OTTO N. WITT and WALTER THEEL (*Ber.*, 1900, 33, 1315—1324).—Cerium can readily be separated from the other metals which usually accompany it in the cerite earths by means of ammonium persulphate. When a solution of a normal cerous salt is boiled with ammonium persulphate, oxidation occurs and a ceric salt is formed, which is at once decomposed by the water present into a basic ceric sulphate and free acid. If this acid is neutralised as fast as it is produced, the reaction becomes quantitative, and the whole of the cerium present is precipitated as basic ceric sulphate, whilst the other earths remain in solution. The normal salts of the cerite earths have a faintly acid reaction to litmus paper, but do not react with Congo paper, and the boiling liquid must therefore be maintained faintly acid to litmus, but neutral to Congo paper by the cautious addition of sodium carbonate solution or finely powdered calcium carbonate until the reaction is complete. The precipitate can readily be washed and the filtrate is quite free from cerium. The method is of special value for use in conjunction with Schéele's method of fractionation of the cerite earths, according to which the cerium is retained in the mixture of nitrates, whilst the lanthanum is gradually

removed, the result being solutions of neodymium and praseodymium mixed with cerium, from which the latter can then be removed by the persulphate process.

A. H.

Microchemical Researches on Yttrium, Erbium, and Didymium. By M. E. Pozzi-Escot and H. C. Couquet (*Compt. rend.*, 1900, 130, 1136).—When treated with ammonium chromate, yttrium salts yield a chromate separating in elongated, hexagonal crystals having a violet tint; the corresponding didymium salt is obtained in orange, prismatic crystals exhibiting twinning, whilst the erbium compound crystallises with great difficulty and is usually amorphous.

With a solution of chromium trioxide in concentrated sulphuric acid, filiform crystals are obtained from yttrium salts, large, ill-defined crystals from erbium compounds, and amorphous precipitates gradually becoming crystalline from didymium derivatives.

These rare earth metals also form characteristic double chlorides with palladium chloride.

G. T. M.

Samarium. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1900, 130, 1185—1188. Compare this vol., ii, 347).—The intermediate fractions obtained in the separation of neodymium and samarium show no indication of the presence of a third element.

A nitric acid solution of the samarium salts shows the following bands: λ 559 (feeble), 529 (very feeble, narrow), 498 (feeble, rather narrow), 476 (strong, diffused), 463 (very strong, rather wide), 453 (very feeble, narrow), 443 (very wide and diffused), 417 (very strong, wide), 407 (feeble, narrow and joining the next), 402 (very strong, wide), 390 (feeble, very wide and diffused), 375 (strong, wide), 362 (strong, wide).

The reversion spectra of the salts either in hydrochloric or nitric acid solution gave the three following bands: λ 644 (wide), 600 (middle of the principal band which extends from 610 to 593), and 564 (middle of the third band). No fourth band corresponding with the 614.4 band of Lecoq de Boisbaudran could be detected in the pure samarium examined.

Analyses of samarium sulphate gave numbers varying between 148 and 147.2 (O = 16) for the atomic weight of the metal; the author is, however, not satisfied with the method employed.

The *double nitrate*, $\text{Sm}(\text{NO}_3)_8 \cdot 3\text{Mg}(\text{NO}_3)_2 \cdot 24\text{H}_2\text{O}$, forms large, pale yellow, rhombohedral crystals melting at 94.5—93.5°. The *nitrate*, $\text{Sm}(\text{NO}_3)_8 \cdot 6\text{H}_2\text{O}$, forms thick, orange-yellow crystals which are very hygroscopic and melt at 78—79°.

H. R. LE S.

Nature of the Process which occurs at the Aluminium Anode. By KONRAD NORDEN (*Zeit. Elektrochem.*, 1899, 6, 159 and 188).—When aluminium is used as anode in the electrolysis of dilute sulphuric acid, it becomes coated with a substance possessing a high resistance which gives rise to an apparent polarisation of some 20 to 30 volts. The author shows that when an aluminium wire is used alternately as anode and as cathode, the skin formed when the wire is anode is detached from the metal when it is used as cathode, and that when it is again used as anode a fresh coating forms under the old one.

By many repetitions of the process, the skins peel off and a quantity sufficient for an analysis may be collected. Analyses of the coatings formed with different current densities and different concentrations of acid agree well with each other, the average result being: Al_2O_3 , 69.8 per cent.; SO_3 , 13.2 per cent.; H_2O , 14.8 per cent.; SiO_2 , 2.2 per cent. The silica is doubtless due to oxidation of the silicon contained in the aluminium used. In the remaining substance, some of the aluminium is present in the form of small particles of metal. A mixture of a compound, $\text{Al}_2\text{O}(\text{SO}_4)_2 \cdot \text{H}_2\text{O} + 5\text{Al}_2(\text{OH})_6$, with 9.25 per cent. of metallic aluminium would have the composition indicated by the analyses.

T. E.

Preparation of Aluminium [Sulphide, Selenide, Phosphide, and Arsenide]. By HENRI FONZES-DIACON (*Compt. rend.*, 1900, 130, 1314—1316).—Aluminium sulphide, Al_2S_3 , is readily prepared when a mixture containing equivalent proportions of precipitated sulphur and fine aluminium powder is ignited by means of burning magnesium; the combustion is propagated throughout the mass, and a compact, yellowish-grey product is obtained, which is decomposed by water, yielding hydrogen sulphide. A mixture of antimony sulphide and aluminium, when treated in this way, yields aluminium sulphide and metallic antimony.

Aluminium selenide, Al_2Se_3 , is obtained in a precisely similar manner as a yellowish-grey, fibrous mass, which evolves hydrogen selenide when treated with water.

Aluminium phosphide, Al_2P_3 , is prepared by igniting an intimate mixture of aluminium and red phosphorus; when moistened, it evolves non-inflammable hydrogen phosphide, the yield of this gas being practically theoretical.

Aluminium arsenide is a black, friable mass, produced from a mixture of aluminium and metallic arsenic; the hydrogen arsenide liberated from this compound by the action of water is almost wholly absorbed by copper sulphate, and the decomposition is quantitative.

A mixture of antimony and aluminium is not ignited by a fuse of magnesium or an aluminium cartridge (a mixture of aluminium and barium dioxide fastened to a strip of magnesium); its combustion may, however, be effected by adding a small quantity of sodium peroxide; the product is a black, friable mass, which, when treated with water, evolves a considerable amount of hydrogen antimonide. G. T. M.

Manganous Fluoride. By HENRI MOISSAN and VENTURI (*Compt. rend.*, 1900, 130, 1158—1162).—*Manganous fluoride*, MnF_2 , is best prepared by dissolving manganese in dilute hydrofluoric acid contained in a silver basin, which is kept cool by a rapid current of cold water; on boiling the resulting solution, the manganous fluoride is precipitated as a white, crystalline powder, which is collected and dried at 120° .

Manganese is readily attacked by hydrogen fluoride with the development of much heat, and manganous fluoride is thus obtained as a rose-coloured, fused mass. Pure manganous fluoride may also be formed by heating hydrated manganese silicofluoride to 1000° in a current of hydrogen fluoride. When manganous carbonate is dissolved

in dilute hydrofluoric acid, the resulting solution contains the hydrated fluoride; when the solution is boiled, a certain amount of the anhydrous salt is deposited.

Manganous fluoride may be recrystallised from fused manganous chloride, when it is obtained as rose-coloured prisms of sp. gr. 3.98, and melting at 856° . Manganous fluoride is completely reduced by hydrogen at 1000° , but only very slowly at 500° ; it is only slowly decomposed by fluorine in the cold, but readily on heating, manganese trifluoride being formed (this vol., ii, 280).

It is not attacked by chlorine in the cold; but at 1200° partial decomposition occurs, manganous chloride being formed. Dry oxygen acts only slowly on manganous fluoride at 400° , but at 1000° it is completely decomposed, and manganese tetroxide is formed; when heated to 1000° in an atmosphere of sulphur, it is rapidly converted into green manganous sulphide. It is not decomposed by carbon at 1200° , but at 1000° both silicon and boron readily decompose it, with formation, in the first case, of manganese silicide, and in the second, of boron fluoride and manganese boride. When manganous fluoride is boiled with water, manganese oxyfluoride and hydrofluoric acid are first produced; if the boiling is continued, then a mixture of hydrated manganese fluoride and oxyfluoride is deposited. At 1200 — 1300° , manganous fluoride is converted by steam into manganous oxide, and by hydrogen sulphide into green manganous sulphide. It is sparingly soluble in liquid ammonia, a crystalline powder being produced, probably of the composition $3\text{MnF}_2 \cdot 2\text{NH}_3$, which slowly evolves ammonia. When heated at 1200° in an atmosphere of ammonia, the fluoride is partially reduced.

Sodium, potassium, aluminium, and magnesium reduce manganous fluoride below a red heat, cold concentrated nitric acid and hydrochloric acid dissolve it readily, and dilute hydrochloric acid and acetic acid only slowly; but hydrofluoric acid is without action on it, and sulphuric acid decomposes it with evolution of hydrogen fluoride. It is decomposed by fused alkali carbonates, potassium hydroxide, potassium nitrate, and potassium chlorate, and with chlorine or bromine water manganese dioxide and hydrofluoric acid are produced. Manganous fluoride is practically insoluble in water, alcohol, or ether.

H. R. LE S.

Cause of the Evolution of Oxygen when Oxidisable Gases are Absorbed by Permanganic Acid. By HARMON N. MORSE and H. G. BYERS (*Amer. Chem. J.*, 1900, 23, 313—322. Compare Morse and Reese, *Abstr.*, 1898, ii, 588).—It is shown that no oxygen is liberated, either during the absorption of carbon monoxide by neutral aqueous potassium permanganate, or during subsequent prolonged agitation of the neutral solution with the manganese dioxide thus precipitated; if, however, the solution is acidified with sulphuric acid immediately after the absorption, there is a liberation of oxygen just as when the gas is absorbed by an acid solution. The amount of oxygen liberated within a given period increases with the concentration of the solution, and the rate of evolution in any given case diminishes with time, the decrease being most marked in the more

concentrated solutions. With a fixed quantity of carbon monoxide, the quantity of oxygen liberated during absorption with initially acid solutions of potassium permanganate increases with the concentration of the solutions; the same is true of the amount liberated in a given period after the absorption is complete, and the rate of evolution diminishes with time just as in the foregoing case of solutions initially neutral and subsequently acidified. The authors therefore conclude that in acid solution the liberation of oxygen is due to the reduction of the permanganic acid by the precipitated manganese dioxide, rendered active by the sulphuric acid present; the fact that no oxygen is liberated in neutral solutions may be due to either potassium permanganate being more stable than permanganic acid, or to the precipitated manganese dioxide being "saturated" with alkali, or to both causes combined. The falling off with time of the reducing power of the manganese dioxide in acid solution is explained by assuming the initial activity of the manganese dioxide molecules to be due to their simplicity; as the molecules become more complex owing to polymerisation, so do they lose their power of reduction. It is noteworthy that whilst the oxide formed in acidified solutions is, in general (especially in the more concentrated solutions), more active during the first 24 hours than that formed in neutral solutions, the converse is true after 150 hours.

W. A. D.

Revision of the Atomic Weight of Iron. By THEODORE W. RICHARDS and GREGORY P. BAXTER (*Zeit. anorg. Chem.*, 1900, 23, 245—254).—The method employed is the reduction of ferric oxide to iron in a current of hydrogen. The operation is carried out in a porcelain tube at 900°, and a considerable time is required to effect complete reduction. In the first series of experiments, the iron, purified by electrolytic deposition, was dissolved in nitric acid, the solution precipitated with ammonia, and the precipitate of hydroxide washed with water and converted into oxide by heating at 900° to a constant weight. Two experiments with this oxide gave the mean value $\text{Fe} = 55.900$ ($\text{O} = 16$). In the second series, the ferric oxide was prepared by heating the carefully purified nitrate at 900° to a constant weight. The mean of five experiments gave the value $\text{Fe} = 55.883$.

The ferric oxide prepared from the nitrate was more easily reduced than that prepared from the hydroxide. A careful examination of the ferric oxide showed that it contained only a very minute quantity of included gases, chiefly nitrogen, and also a very minute quantity of platinum, derived from the vessel employed, the total impurities being such as to increase the results by only 0.01 per cent.

E. C. R.

Thermochemistry of Iron and Steel. By EDWARD D. CAMPBELL (*J. Amer. Chem. Soc.*, 1900, 22, 205—206).—The author now finds that the heat of solution of steel in slightly acid ammonium copper chloride solution does not depend to any considerable extent on the heat or mechanical treatment to which the metal has been subjected, or on its chemical composition, the extreme variation being less than

2 per cent. He therefore withdraws his previous paper on this subject (Campbell and Thompson, *Abstr.*, 1898, ii, 323). E. G.

Allotropic Transformations of Iron and Nickel Alloys. By L. DUMAS (*Compt. rend.*, 1900, 130, 1311—1314. Compare *Abstr.*, 1899, ii, 352, 630).—The paper contains the diagrams and tabulated results of experiments on the transformation points of alloys of iron and nickel containing traces of carbon and manganese, and in one case chromium. The diagrams indicate that the curves of the transformation points of iron (non-reversible transformation) are distinct from those of nickel (reversible transformation), and there is therefore no minimum transformation temperature corresponding with the existence of a eutectic alloy. Nickel lowers the transformation points of iron, and iron lowers those of nickel, although at first it raises them. The magnetism of alloys, containing less than 25 per cent. of nickel, which have not been cooled below 0°, is entirely due to the iron present; when the percentage is greater than 26, the magnetic properties are wholly derived from the nickel; the alloys containing intermediate amounts of nickel are almost non-magnetic at ordinary temperatures, owing to the simultaneous depression of the transformation points of both their constituents. G. T. M.

Electro-deposition of Chromium. By SHERARD COWPER-COLES (*Chem. News*, 1900, 81, 16—18).—Electro-deposited chromium is comparatively soft, and tarnishes; a bright deposit can be obtained from a solution of 25 parts of chromium chloride in 75 parts of water, working at 190° F. with a current of 40 to 50 ampères per square foot. In the cold, gas is evolved at both electrodes, but no metallic deposit is obtained until excess of hydrochloric acid is added. A solution of 100 parts of chrome alum in 100 parts of water with 12 parts of barium sulphate does not yield a metallic deposit by electrolysis.

D. A. L.

Enantiotropy of Tin. IV. By ERNST COHEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1900, 2, 464—467. Compare this vol., ii, 83 and 212).—Another case of 'tin plague' infection is noticed, and emphasis is laid on the fact that the corrosion of tin is independent of the mode of preparation of the metal. The occurrence of 'tin plague' in organ pipes suggested that the conversion of the white into the grey modification below 20° might be accelerated by mechanical vibration, but a test experiment gave a negative result. J. C. P.

Hydrolysis of some Chlorine Compounds of Platinum, Gold, and Tin on Standing, and under the Influence of Light. By FRIEDRICH KOHLRAUSCH (*Zeit. physikal. Chem.*, 1900, 33, 257—279).—Platinic chloride crystallises with 5H₂O, but the fifth molecule cannot be removed without decomposition of the chloride. Hittorf and Salkowski (*Abstr.*, 1899, ii, 398), and Dittenberger and Dietz (*Abstr.*, 1899, ii, 629), have shown that in the electrolysis of this compound the platinum goes to the anode. These facts point to the existence of an oxy-acid, PtCl₄OH₂. The author finds that even in the dark the conductivity of solutions of this compound increases, especially when they are left in contact with the electrodes; the conductivity rises

rapidly when the solutions are exposed to sunlight; red, yellow, blue and white light are increasingly efficient in producing the hydrolysis that this increase of conductivity points to. When the limit of hydrolysis in dilute solutions is reached, it seems as if all the chlorine were present as hydrogen chloride; in more concentrated solutions, the hydrolysis does not go so far. The numbers obtained for the molecular conductivity of freshly prepared solutions agree fairly well with the supposition that PtCl_4OH_2 is a moderately dissociated monobasic acid. The hydrolysis is accompanied by a change in colour from an almost greenish-yellow to a bright orange, and in the more dilute solutions a sort of fluorescence is observed, which the author attributes to the separation of finely divided particles, possibly of platinum hydroxide. Similar changes of conductivity take place in solutions of chloroplatinic acid of less than 1/10th normal strength; stronger solutions are stable and not affected by light. For a freshly-prepared solution containing 0.0002 gram-equivalents per litre, $\mu = 380$; when hydrolysed by light, μ for the same solution = 1048; here again, it seems as if all chlorine were present as hydrogen chloride.

In solutions of gold chloride, light causes no hydrolysis; a slight increase in conductivity with time is set down to the action of the electrodes.

The change in conductivity of stannic chloride solutions with time has been accurately traced; the change becomes less rapid as hydrolysis proceeds, and light is found to have no hydrolysing influence. At higher temperatures, the rate of hydrolysis is much increased. Comparison of the results for platinum and stannic chlorides show that the two compounds are essentially different in type.

The temperature coefficient of the conductivity has been determined for the above solutions, and found to agree approximately with the value obtained in the case of acids generally. J. C. P.

[Similar experiments on the hydrolysis of stannic chloride solutions have been made by Kowalewsky (this vol., ii, 256).—ABTRACTOR.]

Mineralogical Chemistry.

Magnetic Iron-Ores from Eastern Ontario. By FREDERICK J. POPE. (*Trans. Amer. Inst. Mining Eng.*, California Meeting, Oct. 1899, 34 pp.).—These ores occur in gneisses and schists, or at the contacts of these with crystalline limestone, and also in gabbros and anorthosites. Descriptions and twelve detailed analyses are given of the ores from several mines. The magnetites occurring in the gabbro differ from the others in being titaniferous and in containing small amounts of vanadium (up to 0.63 per cent. V_2O_5) and of nickel and cobalt (compare Abstr., 1899, ii, 109; this vol., ii, 283).

Details are given of the methods used in estimating titanium and vanadium, and also for the preparation of pure vanadic oxide from these ores. L. J. S.

Minerals from Narsarsuk, S. Greenland. By GUSTAV FLINK (*Meddelelser om Grönland*, 1899, [1900], 24, 7—180).—A detailed description is given of 34 mineral species, of which 9 are new, collected by the author in 1897 on the plateau of Narsarsuk, near Julianehaab, S. Greenland. The minerals occur in drusy cavities bounded by large crystals of microcline and *agirite*, which locally form pegmatite masses in the syenite of the region; this on weathering leaves the minerals in the coarse gravel on the surface. Analyses, several of which were made by R. Mauzelius, are given of the following minerals.

Rhodochrosite occurs as small rhombohedra, and is frequently altered to a black, powdery substance. Analyses of the least altered material gave:

MnO.	FeO.	CaO.	O, CO ₂ , H ₂ O.	Total.	Sp. gr.
57.06	15.76	2.68	[24.50]	100.00	3.666

Parisite (compare Abstr., 1895, ii, 401).—The *parisite* from Greenland differs from the original *parisite* from Colombia in several of its most important characters. The former has a rhombohedral instead of hexagonal development, and although several crystal forms are present few are common to both occurrences; it is also frequently twinned on (111) and has no cleavage, but there is sometimes a parting parallel to (111). The sp. gr. (3.902 Greenland, 4.3915 Colombia) and refractive indices also differ. Formula, $\text{CeFCa}(\text{CO}_3)_2$. The Colombian mineral has the formula $(\text{CeF})_2\text{Ca}(\text{CO}_3)_3$ (Abstr., 1899, ii, 600), but there is, however, not sufficient reason to consider that these are two distinct minerals. Analysis:

CO ₂ .	Ce ₂ O ₃ .	(La, Di) ₂ O ₃ .	Y ₂ O ₃ .	CaO.	Na ₂ O.	K ₂ O.	F.	Total, less O for F.
26.54	28.14	22.88	1.23	17.13	0.19	0.12	5.82	99.60

Cordylite (*barium-parisite*).—This new mineral occurs as small, hexagonal, club-shaped crystals, with $[a:c = 1:3.3865]$; for *parisite*, $a:c = 1:3.3645$. The crystals are pale wax-yellow, clear and transparent, and there is a distinct basal cleavage. Optically uniaxial and negative. Sp. gr., 4.31. Formula, $(\text{CeF})_2\text{Ba}(\text{CO}_3)_2$, which is the same as that of the Colombian *parisite* with barium in place of calcium. Analysis:

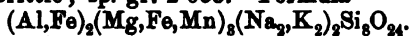
CO ₂ .	ThO ₂ .	Ce ₂ O ₃ .	(La, Di, &c.) ₂ O ₃ .	Y ₂ O ₃ .	FeO.	BaO.	CaO.	H ₂ O.	F.	Insol.
23.47	0.30	23.72	25.67	trace	1.43	17.30	1.91	0.80	[4.87]	2.68

Ancylite.—The orthorhombic crystals of this new mineral are octahedral in habit, with markedly curved faces of the forms {101} and {011}; $[a:b:c = 0.916:1:0.9174]$. The colour is light yellow inclining to orange, but also brownish or greyish. Sp. gr. 3.95. Formula, $4\text{Ce}(\text{OH})\text{CO}_3, 3\text{SrCO}_3, 3\text{H}_2\text{O}$. Traces of Y_2O_3 , MnO and fluorine are also present. The mineral is somewhat allied to the Norwegian *weibeyite*. Analysis:

CO ₂ .	ThO ₂ .	Ce ₂ O ₃ .	(La, Di, &c.) ₂ O ₃ .	FeO.	SrO.	CaO.	H ₂ O.	Insol.	Total.
23.28	0.20	22.22	24.04	0.35	21.03	1.52	6.52	0.60	99.76

Spodiophyllite.—This new mineral occurs as rough, hexagonal prisms or sometimes as thin, trigonal plates; it is optically uniaxial and

negative. There is a perfect basal cleavage with pearly lustre. Colour, ash-grey; very brittle; sp. gr. 2·633. Formula



The mineral resembles the micas and chlorites in its physical characters, but differs from them in containing no water; it is a meta-silicate related in composition to *segitrite* and *arfvedsonite*. Analysis:

SiO_2	Fe_2O_3	Al_2O_3	FeO	MnO	MgO	Na_2O	K_2O	Total.
53·61	11·24	4·27	4·13	0·64	10·16	8·55	7·80	100·40

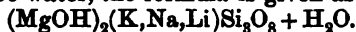
Catapleiite.—Three types of crystals are distinguished: the one analysed when considered as hexagonal has $[a:c=1:1\cdot3509]$. Basal sections are in part uniaxial and in part biaxial with $2E=30^\circ$. When a crystal of this type is heated to 30° , or even when held in the warm hand, the twin lamellæ seen in a basal section disappear, and the whole becomes optically uniaxial. It has the usual formula, $\text{Na}_2\text{SiO}_3\cdot\text{H}_4\text{Zr}(\text{SiO}_4)_2$. Analysis:

SiO_2	ZrO_2	FeO	Na_2O	H_2O	Total.	Sp. gr.
44·70	30·85	0·71	14·09	9·07	99·38	2·781

Polyolithionite.—This agrees with *zinnwaldite* in the optical characters and crystal angles, but differs from it in containing more alkalis and silica. Sp. gr., 2·701. Formula, $(\text{Al,Fe})_4(\text{Li},\text{K},\text{Na})_7\text{F}_2\text{Si}_{16}\text{O}_{46}$. The mineral from Narsarsuk contains more potassium and less sodium than *Lorenzen's* original polyolithionite from the neighbouring locality, *Kangerdluarsuk* (Abstr., 1886, 677). Analysis:

SiO_2	Al_2O_3	Fe_2O_3	MnO	Li_2O	K_2O	Na_2O	F.	Total, less O for F.
58·68	10·24	4·02	0·31	8·24	11·05	1·61	8·16	98·87

Tainiolite.—This new mineral is a member of the mica group; it has the form of strips or bands and so differs in habit from other micas. The colourless crystals are monoclinic, with angles very near those of *biotite*. There is a perfect basal cleavage; it is optically biaxial and negative; $2E=50^\circ$; sp. gr., 2·86. Assuming the deficiency in the analysis to be water, the formula is given as



This composition distinguishes *tainiolite* from all other micas.

SiO_2	Al_2O_3	FeO	MgO	K_2O	Na_2O	Li_2O	Total.
52·2	2·7	0·6	19·1	11·5	1·8	3·8	91·3

Lorenzenite.—The small, acicular crystals of this new mineral are orthorhombic $[a:b:c=0\cdot6042:1:0\cdot3592]$. They have a high adamantine lustre, and are colourless to brownish, with sometimes black ends, they then resemble lucifer matches in appearance; sp. gr., 3·42. Formula, $\text{Na}_2(\text{TiO})_2\text{Si}_2\text{O}_7$. Analysis:

SiO_2	TiO_2	ZrO_2	Na_2O	K_2O	H_2O	Total.
34·26	35·15	11·92	17·12	0·37	0·77	99·59

Leucosphenite.—The white crystals of this new mineral are monoclinic, with a prismatic habit and wedge-shaped terminations $[a:b:c=0\cdot5813:1:0\cdot8501; \beta=93^\circ23']$. Sp. gr., 3·05. Formula, $\text{BaNa}_4(\text{TiO})_2(\text{Si}_2\text{O}_5)_5$. Like *petalite*, this is a dimetasilicate. The

mineral shows certain crystallographic and chemical relations to eudidymite ($\text{BeSiO}_3, \text{HNaSi}_2\text{O}_6$). Analysis :

SiO_2	TiO_2	ZrO_2	BaO	Na_2O	K_2O	H_2O	Total.
56.94	13.20	3.50	13.75	11.14	0.56	0.31	99.40

Elpidite.—This is very abundant at Narsarsuk, but it is usually much altered and has the appearance of sticks of decayed wood. Fresh, clear, and transparent crystals are very rare; these give $[a:b:c=0.51008:1:0.97813]$. The material analysed by Lindström (Abstr., 1895, ii, 401) was not fresh, and the whole of the water is probably due to alteration, in which case the formula of the mineral would be $\text{Na}_2\text{Si}_2\text{O}_5, \text{Zr}(\text{Si}_2\text{O}_5)_2$.

Narsarsukite.—This new mineral occurs plentifully at Narsarsuk as tabular or cube-shaped, tetragonal crystals with $[a:c=1:0.52352]$. They are honey-yellow, and have a perfect prismatic cleavage. Sp. gr. 2.751. Formula, $12\text{SiO}_2, 2\text{TiO}_2, 3\text{Na}_2\text{O}, \text{FeF}$. Analysis by Christensen :

SiO_2	TiO_2	Fe_2O_3	Al_2O_3	MnO	MgO	Na_2O
61.63	14.00	6.30	0.28	0.47	0.24	16.12
F. H ₂ O. Total less O for F.						
0.71 0.29 99.74.						

Chalcolamprite.—This is a new member of the pyrochlore group. It is found as small, regular octahedra on crystals of *ægirite*. The name *chalcolamprite* alludes to the metallic, coppery lustre on the faces of the crystals. Thin sections of the mineral are translucent, straw-yellow, and isotropic. Sp. gr. 3.77. Formula, $\text{R}''\text{Nb}_2\text{O}_6\text{F}_2 + \text{R}'\text{SiO}_3$. Analyses: I. *Chalcolamprite*. II. *Endeiolite*.

	Nb_2O_5	SiO_2	TiO_2	ZrO_2	Ca_2O_3	Fe_2O_3	MnO	CaO	K_2O
I.	59.65	10.86	0.52	5.71	3.41	1.87	0.44	9.08	0.38
II.	59.93	[11.48]	0.76	3.78	4.43	2.81	0.37	7.89	0.43

	Na_2O	H_2O	F.	Total less O for F.
I.	3.99	1.79	5.06	100.63
II.	3.58	4.14	0.69	100.00

Endeiolite.—This is also a new member of the pyrochlore group; it occurs as small, brown octahedra, which are remarkable in being sometimes twinned on the spinel law. Sp. gr. 3.44. Formula, $\text{R}''\text{Nb}_2\text{O}_6(\text{OH})_2 + \text{R}'\text{SiO}_3$. *Endeiolite* differs from *chalcolamprite* in having hydroxyl in place of fluorine, and both minerals differ from *pyrochlore* in having $\text{R}'\text{SiO}_3$ in place of $\text{R}''(\text{Ti}, \text{Th}, \text{Zr})\text{O}_3$. *Microelite* ($\text{Ca}_2\text{Ta}_2\text{O}_7$) also occurs at Narsarsuk (Abstr., 1895, ii, 401).

Yttrium-apatite.—This forms small, short, hexagonal prisms, which are opaque, with an enamel white colour and a metallic lustre on the surface. Sp. gr. 3.24. The results of the analysis agree with those required for the apatite formula, but part of the lime is replaced by rare earths. The insoluble portion consists of *ægirite* and *neptunite*.

P ₂ O ₅ .	CaO.	Y ₂ O ₃ , &c.	Ce ₂ O ₃ , &c.	MgO.	MnO, FeO.	H ₂ O.
41.12	47.67	3.36	1.52	0.79	traces	0.22
		F.	Insol.	Total less O for F.		
		3.59	2.63	99.37		

Another type of apatite occurring as clear, colourless, hexagonal prisms also contains rare earths.

Detailed descriptions are given of the crystallographic and optical characters and modes of occurrence of each of the above minerals, and also of epididymite, eudidymite, ægirite, arfvedsonite, eudialyte, neptunite, &c. The paper is illustrated by nine plates. L. J. S.

Britholite, a New Mineral. By CHR. WINTHER (*Meddelelser om Grønland*, 1899 [1900], 24, 190—196).—This is found in the pegmatites in the nepheline-syenite at Nauyasakik, near Julianehaab, Greenland. The opaque, brown crystals are apparently hexagonal prisms with pyramids, but really consist of biaxial orthorhombic individuals twinned together as in aragonite; $[a:b:c=0.620:1:0.423]$. $H=5\frac{1}{2}$; sp. gr. 4.446. Formula,



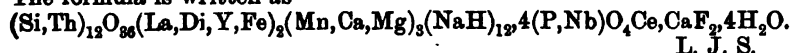
Analysis by C. Christensen:

SiO ₂ .	P ₂ O ₅ .	(Ca, La, Di) ₂ O ₃ .	Fe ₂ O ₃ .	CaO.	MgO.	Na ₂ O.
16.77	6.48	60.54	0.43	11.28	0.13	1.85
		H ₂ O.	F.	Total.		
		1.27	1.33	100.08		L. J. S.

Steenstrupine. By O. B. BOEGGILD (*Meddelelser om Grønland*, 1899 [1900], 24, 203—213).—Besides on the Frith of Kangerdluarsuk, steenstrupine has now been found at other localities in the nepheline-syenite district about Julianehaab, Greenland. The mineral usually occurs as isolated crystals, of which three types are distinguished. Crystals from one of the new localities, namely Tutop Agdlerkofsa, are of a different type from those analysed by Blomstrand (Abstr., 1898, ii, 296); they are brownish-black, contain fewer enclosures, and are less altered; the birefringence and dichroism are uniform throughout each crystal; streak colourless; sp. gr. 3.5122; analysis by C. Christensen gave:

SiO ₂ .	Nb ₂ O ₅ .	P ₂ O ₅ .	ThO ₂ .	(Ca, La, Di) ₂ O ₃ .	Y ₂ O ₃ .	Fe ₂ O ₃ .
26.72	4.37	8.19	2.13	29.60	0.36	2.67
				Total		
MnO.	CaO.	MgO.	Na ₂ O.	H ₂ O.	F.	less O for F.
6.60	2.33	0.31	11.23	3.45	1.24	98.68

The formula is written as



L. J. S.

Schizolite, a New Mineral. By CHR. WINTHER (*Meddelelser om Grønland*, 1899 [1900], 24, 196—203).—This is found as pink prisms or radiated groups in granular albite, and also rarely in pegmatite, in the nepheline-syenite near Julianehaab, Greenland. The habit, cleavage

and axial ratios [$a:b:c = 1.1496:1:1.0343$; $\beta = 85^\circ 32'$] of the monoclinic crystals closely resemble those of pectolite, of which the mineral may be considered to be a manganese variety, like manganopectolite (Abstr., 1891, 407). Sp gr., 3.089. Formula,

$15(\text{Si,Ti})\text{O}_2, 10(\text{Ca,Mn,Fe,Ce})\text{O}, 4(\text{Na,H})_2\text{O}$,
from analysis I, by C. Christensen; the formula of pectolite being $3\text{SiO}_2, 2\text{CaO}, (\text{Na,H})_2\text{O}$.

	SiO ₂ .	TiO ₂ .	CaO.	Y ₂ O ₃ .	FeO.	MnO.	CaO.	MgO.	Na ₂ O.	H ₂ O.	Total.
I.	51.06	0.68	1.47	—	2.79	12.90	19.48	—	10.71	1.36	100.45
II.	51.44	—	—	2.40	2.01	11.69	20.53	0.13	9.50	2.25	99.95

A variety of schizolite occurs in pegmatite at another locality near Julianehaab as very small and indistinct cube-like crystals and plates. Sp. gr., 3.084. Formula, $3\text{SiO}_2, 2(\text{Ca,Mn,Fe,Mg,Y})\text{O}, (\text{Na,H})_2\text{O}$, from analysis II, by C. Christensen. L. J. S.

Action of Ammonium Chloride on Natrolite, Scolecite, Prehnite, and Pectolite. By FRANK W. CLARKE and GEORGE STEIGER (*Amer. J. Sci.*, 1900, [iv], 9, 345—351. Compare this vol., ii, 24, 219).—Natrolite (from Bergen Hill, New Jersey, anal. I) and scolecite (from Whale Cove, Grand Manan Island, New Brunswick, anal. II) when heated at 350° with ammonium chloride in a sealed tube, both give the product $(\text{NH}_4)_2\text{Al}_2\text{Si}_3\text{O}_{10}$. No soluble silica is liberated when the original minerals or this ammonium natrolite are ignited. The formulae of natrolite and scolecite are therefore written as $\text{Na}_2\text{Al}_2\text{Si}_3\text{O}_{10} + 2\text{H}_2\text{O}$ and $\text{CaAl}_2\text{Si}_3\text{O}_{10} + 3\text{H}_2\text{O}$ respectively, by which they are represented as salts of the acid $\text{H}_8\text{Si}_3\text{O}_{10}$.

Prehnite (from Paterson, New Jersey, anal. III) behaves quite differently, ammonium chloride having very little action at 350° ; very little soluble silica is liberated on ignition. These results support the orthosilicate formula $\text{H}_2\text{Ca}_2\text{Al}_2(\text{SiO}_3)_3$ for prehnite.

Further experiments made on pectolite (this vol., ii, 24) do not lead to any definite results; the ammonium chloride reaction varies in different experiments and is never complete.

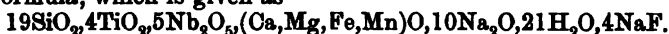
	SiO ₂ .	Al ₂ O ₃ .	Fe ₂ O ₃ .	CaO.	Na ₂ O.	H ₂ O at 100°	H ₂ O above 100° .	Total.
I.	46.62	26.04	—	1.48	15.69	0.39	10.18	100.38
II.	45.86	25.78	—	13.92	0.41	0.40	13.65	100.02
III.	42.31	19.95	6.20	26.63	—	5.02		100.11

L. J. S.

Epistolite, a New Mineral. By O. B. BOGGILD (*Meddelelser om Grönland*, 1899, [1900], 24, 183—190).—Epistolite was found as large, thin, rectangular plates in pegmatite veins and in granular albite at four localities in the nepheline-syenite region about Julianehaab, S. Greenland. Crystals are rare; they are monoclinic with approximately [$a:b:c = 0.803:1:1.206$; $\beta = 74^\circ 45'$]. The colour is greyish or brownish, but on the perfect basal cleavage it is silver-white, with a strong pearly lustre, $H = 1-1\frac{1}{2}$, very brittle; sp. gr. 2.885. Analysis by C. Christensen gave:

SiO ₂	Nb ₂ O ₅	TiO ₂	FeO.	MnO.	CaO.	MgO.
27.59	33.56	7.22	0.20	0.30	0.77	0.13
				Total less O for F.		
	Na ₂ O.	H ₂ O.	F.			
	17.59	11.01	1.98	99.52		

There is also a trace of potassium, but no tantalum or zirconium; 1.75 per cent. of the water is lost below 100°, and is omitted from the formula, which is given as



Epistolite contains more niobium than any other silicate. L. J. S.

Meteorite from Quesa, Spain. By EDUARDO BOSCÁ Y CASANOVES (*Actas Soc. Española Hist. Nat.*, 1899, 53—56).—This iron fell at Quesa, in Valencia, on August 1st, 1898; it weighs 10670 grams, and has the fine grained structure of an ataxite (compare following abstract). Sp. gr. 6.48. Analyses by Peset gave I for the oxidised outer portion, and II for the interior of the mass.

	Fe.	Ni.	Co, Mn, &c.	O.	Total.
I.	79.07	17.95	traces	2.98	100.00
II.	81.35	18.35	0.30	—	100.00

L. J. S.

Meteoric Iron from Quesa, Spain. By EMIL W. COHEN (*Mitth. naturwiss. ver. f. Neu-Vorpommern Rügen, Berlin*, 1900, 31, 63—66. Compare preceding abstract).—A new examination of a larger piece of this iron shows the structure to be octahedral with lamellæ of medium width. A new analysis (I) has been made, since the previous analysis by Peset shows much more nickel than any other known octahedrite. The previous determination of the fine-grained structure was based on the examination of small fragments from the external part of the mass; this is much poorer in nickel (anal. II) than the interior.

	Fe.	Ni+Co.	P.	Total.
I.	88.73	10.85	0.15	99.73
II.	95.56	4.40	—	99.96

L. J. S.

Gases Evolved by the Springs of Mont-Dore. By F. PARMENTIER and A. HURION (*Compt. rend.*, 1900, 130, 1190—1191).—The gas evolved by the spring water of Mont-Dore has the following percentage composition: Carbon dioxide, 99.50; nitrogen, 0.49; argon, 0.01.

H. R. LE S.

Combustible Gases of Salsomaggiore. By RAFFAELE NASINI and ROBERTO SALVADORI (*Gazzetta*, 1900, 30, i, 281—296).—Analyses are given of the various gases which are evolved, together with the saline waters and petroleum, from the springs of Salsomaggiore. The gases, which burn with a luminosity about equal to that of ordinary coal gas, consist for the most part of methane and ethane, with varying and, in general, small proportions of unsaturated hydrocarbons, nitrogen and carbon dioxide.

T. H. P.

Physiological Chemistry.

The Percentage Oxygen Capacity and Total Oxygen Capacity and the Total Mass of Blood in Man. By JOHN S. HALDANE and J. LORRAIN SMITH (*Proc. Physiol. Soc.*, 1900, v—vi; *J. Physiol.*, 25).—The oxygen capacity of the hæmoglobin in ox-blood was first determined by the ferricyanide method. A small volume of human blood was then compared colorimetrically with the ox-blood, and its percentage oxygen capacity calculated, for the colour of the blood runs parallel to its power of absorbing oxygen. In healthy human blood, the percentage oxygen capacity is between 16 and 21. The total oxygen capacity was determined by allowing the subject of the experiment to breathe and absorb a known volume of carbon monoxide. The percentage saturation of the hæmoglobin was determined in a drop of the blood by the carmine method, and from the result the total capacity of the blood for absorbing carbon monoxide or oxygen could easily be calculated. The total volume of the blood was then calculated from the two preceding numbers, and its mass by multiplying the volume by the specific gravity. The commonly accepted estimate that the weight of the blood is equal to about a twelfth of the body weight is much too high; the average amount is only a twentieth of the body weight.

W. D. H.

The Volume, Total Oxygen Capacity, and Percentage Oxygen Capacity of the Blood in Chlorosis and Pernicious Anæmia. By J. LORRAIN SMITH (*Proc. Physiol. Soc.*, 1900, vi—vii; *J. Physiol.*, 25).—In chlorosis, the total oxygen capacity is approximately normal, but the percentage oxygen capacity is markedly diminished (often below 50 per cent.); the volume of the blood is markedly increased. The decrease in the number of red corpuscles and in the amount of hæmoglobin cannot be regarded as due simply to increase in the plasma. In pernicious anæmia, both percentage and total oxygen capacity are greatly diminished, but the volume of the blood is increased. The decrease in the number of the red corpuscles, and in the amount of hæmoglobin, is greater than can be explained by the increase in the volume of the blood.

W. D. H.

Relationship of Iron to Blood-formation. By EMIL ABDERHALDEN (*Zeit. Biol.*, 1900, 39, 487—523).—Previous portions of the research have shown that inorganic iron, hæmoglobin, and hæmatin in the food are absorbed, and lead to an increase of body weight, and of the blood-pigment. The most important fact now added is that animals on their normal diet assimilate more iron than those kept on a diet poor in iron, to which inorganic iron salts, hæmoglobin, or hæmatin has been added.

W. D. H.

Effect of Ingestion of Alcohol on the Blood of Mother and Fœtus, and on the Milk. By MAURICE NICLOUX (*Compt. rend.*, 1900, 130, 855—858).—Experiments were made on dog, sheep, and guinea-pig. Ingested alcohol passes into the milk. The amounts of

alcohol in the blood and milk of the mother and the blood of the fetus are approximately equal.
W. D. H.

Chemical Changes in the Blood produced by Feeding with Ammonium Sulphate. By THEODOR RUMPF and O. SCHUMM (*Zeit. physiol. Chem.*, 1900, 29, 249—255).—After the administration of ammonium sulphate, the amount of alkali in the blood is diminished; this is chiefly due to a lessening of organic sodium compounds. The sodium chloride and the amount of calcium in the blood are increased; the water is lessened.
W. D. H.

Hæmorrhage and Transfusion in Dogs. By PERCY M. DAWSON (*Amer. J. Physiol.*, 1900, 4, 1—24).—A full account of experiments concerning which a preliminary communication has already been made (this vol., ii, 291). An important new point is that transfusion of Ringer's fluid containing more than 0.026 per cent. of calcium chloride is dangerous. More than this appears to overstimulate the heart; and several cases of death in dogs occurred.
W. D. H.

Gaseous Metabolism of the Submaxillary Gland. By JOSEPH BARCROFT (*J. Physiol.*, 1900, 25, 265—282).—This preliminary paper treats mainly of methods. The form of gas pump used is described in full with illustrations; it is a modification of Töpler's. Haldane's method of gas analysis was employed. Incoagulability of the blood is best brought about in dogs, which were the animals used, by injection of leech extract: this is not absolutely certain to produce incoagulability, but it has the advantage of not influencing the flow of saliva. The amount of oxygen and carbon dioxide in the blood is, however, increased. The anæsthetics found most suitable were morphine and chloroform; the effect of these anæsthetics on the blood gases is inconstant, but the most marked feature is a gradual increase in the carbon dioxide.
W. D. H.

Influence of Asparagine and Ammonia on Proteid Metabolism in Ruminants. By OSCAR KELLNER, A. KÖHLER, F. BARNSTEIN, W. ZIELSTORFF, R. EWERT, and K. WEDEMEYER (*Zeit. Biol.*, 1900, 39, 313—376).—The experiments recorded with full details were performed on four sheep. In two, the amount of proteid in the food was small, in the other two, medium. In the first case, the addition of asparagine furthers the putting on of proteid; ammonium acetate has the same action. In the second case, asparagine has no action in influencing either the digestion or the assimilation of proteid.
W. D. H.

Nuclein Metabolism. By OTTO LOEWI (*Chem. Centr.*, 1900, i, 871; from *Arch. exp. Path. Pharm.*, 44, 1—23).—The quantity of phosphoric and uric acids in the urine largely depends on the amount of nuclein in the food. Allantoin does not occur. After feeding on allantoin, only a small amount of it is found in the urine.
W. D. H.

Energy-value of Flesh and Proteids. By EDOUARD PFLÜGER (*Pflüger's Archiv*, 1900, 79, 537—596).—The article is mainly a

critical review of our knowledge of the subject, and the numerous errors which must be avoided in a study of the metabolism of proteid material. Considerable space is devoted to a criticism of Rübner's methods and results. The urine, after flesh diet, receives contributions from the metabolism of fat, and cannot be considered a purely 'flesh urine.' Rübner's assumption that meat extract takes no part in metabolism is questioned, at any rate in regard to those extractives which do not pass unchanged into the urine. W. D. H.

Influence of Alcohol on Muscular Work. By J. C. TH. SCHEFFER (*Chem. Centr.*, 1900, i, 870—871; from *Arch. exp. Path. Pharm.*, 44, 24—58).—From experiments made with Mosso's ergograph, it appears that alcohol causes first an increase of muscular work, and later a decrease. The irritability passes through corresponding phases. If the peripheral motor nerve apparatus is eliminated in animals by curare, alcohol has no effect. W. D. H.

Transformation of Fat into Glycogen. By CHARLES BOUCHARD and ALEXANDRE DESGREZ (*Compt. rend.*, 1900, 130, 816—822).—In a starving animal, the copious administration of fat does not increase the glycogen of the liver, but there is a rise in that of the muscles. Fat is therefore regarded as one source of the muscular glycogen; another source is the sugar of the blood that leaves the liver. On oxidation, muscular glycogen is stated to pass into the condition of lactic acid, and not into that of sugar. W. D. H.

Action of Soaps in the Body. By IMMANUEL MUNK (*Chem. Centr.*, 1900, i, 676; from *Centr. Physiol.*, 13, 657—661).—When soaps are introduced into the blood, the heart is affected, and the blood pressure sinks. In the case of sodium soaps, Bottazzi (*Arch. Ital. Biol.*, 32, 176) attributes this action to the sodium. This cannot be the case, since to produce such a fall of pressure a quantity of sodium hydroxide is necessary much larger than that which can be formed by dissociation from the soap injected. W. D. H.

Absorption of Fats and Soaps in the Large Intestine. By HARTOG J. HAMBURGER (*Archiv Anat. Physiol. Physiol. Abth.*, 1900, 433—464).—The experiments on dogs which are here recorded show that the large intestine is capable of absorbing fats, this property not being confined, as hitherto thought, to the small intestine. In order to obtain marked absorption, it is necessary to take an emulsion and leave it a long time in the intestine. Admixture with sodium carbonate is unnecessary; sodium chloride, which is rapidly absorbed, will do as well. Admixture with *sapo medicatus* also suffices. Soaps are absorbed, but during absorption are partly converted into fats. This is brought about by the mucous membrane; it can be proved after the removal of the intestine from the body, and is also brought about by the 'surviving' membrane after it is finely minced. Heating the mucous membrane to 80° destroys this property. W. D. H.

Fixation of Alkaline Bases in the Fœtal Body during the last Five Months of Intrauterine Life. By LOUIS HUGOUNENQ (*Compt. rend.*, 1900, 130, 941—942).—The proportion of potassium

and sodium in the ash of fœtuses of different ages was determined. As growth takes place, both bases increase in amount, but the sodium increases more rapidly on account of the richness of cartilage in sodium chloride. The potassium is a predominant element of red blood corpuscles, and in well nourished subjects increases more rapidly than in the cases of malnutrition. W. D. H.

Absorption of Iodides by the Skin. By F. GALLARD (*Compt. rend.*, 1900, 130, 858—861. Compare Abstr., 1899, ii, 503).—The skin of man and animals can absorb aqueous solutions of iodides. The elimination by the urine is slow, so that some accumulation occurs in the tissues. The respiratory mucous membrane only permits the entrance of a very small amount of iodine. W. D. H.

Variations of the Iodine of the Thyroid of New Born Children under various Pathological Influences. By ALBERT CHARRIN and BOURCET (*Compt. rend.*, 1900, 130, 945—948).—In various cachectic conditions of the mother, the new born child is feeble, and often suffers no harm from injections of thyroid extract. There are frequently histological changes in the thyroid of these infants. The present paper records the examination of the thyroid in 32 cases of the kind. In 18 of these, no iodine was found; the maladies of the mother and the child were very different. In the remaining 14 cases, the pathological conditions being here equally variable, the percentage of iodine in the dry gland varied from 0.001 to 0.006. W. D. H.

Hüfner's Method of preparing Pure Glycocholic Acid. By W. A. OSBORNE (*Proc. Physiol. Soc.*, 1900, xi—xii; *J. Physiol.*, 25).—Hüfner (*J. prakt. Chem.* [ii], 1874, 10, and 1879, 19) described an effective method of obtaining glycocholic acid from ox-bile. The main points in the method are that bile is shaken up with ether and hydrochloric acid. In a short time, crystals of glycocholic acid separate out so abundantly as to render the bile almost solid, and may be purified by washing and recrystallisation. Certain observers have cast doubt on the method, and in some districts of Germany success was generally not obtained. In America, also, the separation of the crystals occurred in only 22 per cent. of the specimens of ox-bile examined. The present paper shows that the bile of English oxen and cows gives completely successful results. The method also succeeds with rabbits' bile. W. D. H.

The Maximum Production of Hippuric Acid in Rabbits. By F. H. PARKER and GRAHAM LUSE (*Amer. J. Physiol.*, 1900, 3, 472—484. Compare Abstr., 1899, ii, 312).—In a fasting rabbit fed with lithium benzoate, the amount of glycocine eliminated as hippuric acid in the urine indicates that 4 grams may be derived from the metabolism of every 100 grams of body proteid, and the excretion runs parallel to the proteid destroyed. Administration of carbohydrates has no effect. After gelatin, the number sinks to 3.1 from the combined metabolism of gelatin and proteid; after casein, it is 3.45. After phloridzin and benzoic acid in one experiment, the number was doubled, but this could not be repeated. In metabolism, the proteid

and gelatin molecule may yield glycocine to the amount of at least 3 to 4 per cent.

W. D. H.

Caseinogen of Human Milk. By ERWIN KOBRAK (*Pflüger's Archiv*, 1900, 80, 69—85).—The caseinogen was prepared from centrifugalised milk by the careful addition of acetic acid; various foreign substances were then removed by dialysis, and the product purified by means of alcohol and ether. It differs from the caseinogen of cows' milk, especially in its small degree of acidity; the casein formed from it by rennet is flocculent, not coherent. By repeated solution in alkali and precipitation by acid, a product is finally obtained, practically identical with cow-caseinogen. Human caseinogen is therefore probably a nucleo-proteid identical with that obtained from cows' milk, but containing an admixture of some basic, proteid-like material, possibly histon or protamine.

W. D. H.

[**Glycolytic Action of the Pancreas and of Urine.**] By G. PIERALLINI (*Chem. Centr.*, 1900, i, 828; from *Zeit. Klin. Med.*, 39, 26—31).—The urine, both in health and disease, has no glycolytic action. Search for a glycolytic ferment in the human pancreas removed after death gave uncertain results.

W. D. H.

Lipolytic Ferment in Human Ascitic Fluid. By HARTOG J. HAMBURGER (*Proc. K. Akad. Wetensch. Amsterdam*, 1900, 2, 428—436).—It is extremely probable that the lymph contains an agent which reduces the fat emulsion of the intestine to the extremely finely divided condition in which it is found as the 'molecular basis' of chyle. As the lymph of the villi is difficult to collect in quantity, advantage was taken of a case of ascitic fluid, supposed to be chylous. The opalescent character of this fluid was, however, found not to be due to fat, but to mucoid; nevertheless, it was found possible to make with this fluid, as well as with ordinary horse serum, a perfect "dust-like" emulsion. Possibly the continual movement of the lymph in the villi normally produces a like change. The same ascitic fluid contains also a lipolytic ferment, which acts on the finely divided fat; but for this action, the presence of blood corpuscles and access of air are also necessary. The ferment is a constituent of the chyle rather than of the blood, as Cohnstein and Michaelis consider.

W. D. H.

A Diastatic Ferment in Hen's Eggs. By JOHANNES MÜLLER and M. MASUYAMA (*Zeit. Biol.*, 1900, 39, 542—559).—The yolk of the hen's egg contains, in not unimportant quantities, an enzyme, which is capable of transforming starch into dextrin and sugar (isomaltose).

W. D. H.

Meningocele Fluid. By WLADIMIR VON GULEWITSCH (*Zeit. physiol. Chem.*, 1900, 29, 281—282).—Choline was sought for in a specimen of cerebro-spinal fluid removed from a meningocele, with negative results. This confirms the statement made by Mott and Halliburton (*Abstr.*, 1899, ii, 315) that normal cerebro-spinal fluid does not contain this base.

W. D. H.

The Crystalline Stalk of Acephalous Molluscs. By HENRI COUPIN (*Compt. rend.*, 1900, 130, 1214—1216).—The crystalline stalk

of acephalous molluscs has been regarded as a copulative organ, and as a manubrium to agitate the gastric contents. The present research, carried out on *Cardium edule*, shows that the weight of the organ is 0.03 gram, and it contains 87 per cent. of water. It is regarded as a digestive agent containing the ferments amylase with a little sucrase.

W. D. H.

Solution of Uric Acid by means of Nucleic Acid. By ALBRECHT KOSSEL and GOTO (*Sitzungber. Ges. gesamm. Naturwissensch. Marburg*, 1900, April 6).—It has been previously shown that nucleic acid will unite with certain quantities of purine bases. The present research shows that similar loose combinations are formed between nucleic acid and thymic acid on the one hand, and uric acid on the other, and in this way more uric acid is dissolved than in control specimens where the nucleic acid is absent. It is thus possible that the action of nucleic acid and its compounds in the body may be a factor in determining the solubility of uric acid there. Whether nucleic acid can be used as a therapeutic agent in assisting the solution of uric acid is another possibility.

W. D. H.

Investigation of Urine by a Combination of the Freezing Point and Blood Corpuscle Methods. By HARTOG J. HAMBURGER (*Centr. inn. Med.*, 1900, No. 12).—A combination of the two methods mentioned above affords a means of determining approximately the osmotic pressure due to inorganic constituents (such as sodium chloride) and organic constituents (such as urea). If Δ be determined for the urine, and then, by means of the blood corpuscle method, the osmotic pressure is found equal to that of a saline solution of a certain strength, of which the depression of freezing point is Δ' , then $\Delta - \Delta'$ gives the value to be assigned to urea and similar substances. Examples are given and the question discussed from the theoretical standpoint.

W. D. H.

Glycuronic Acid in Normal Urine. By PAUL MAYER and CARL NEUBERG (*Zeit. physiol. Chem.*, 1900, 29, 256—273).—The work recorded covers much the same ground as that in a paper previously published (this vol., ii, 155). The following additional fact of physiological importance is added, that glycuronic acid compounds are constituents of normal urine; the greatest part of the acid is combined with phenol, and smaller amounts with indoxyl and scatoxyl.

W. D. H.

Elimination of Nitrogen, Sulphates, and Phosphates after Ingestion of Proteid Food. By H. C. SHERMAN and P. B. HAWK (*Amer. J. Physiol.*, 1900, 4, 25—49).—The experiments were conducted by the authors on themselves. The urine was collected at three hour intervals; the rates of excretion of nitrogen and sulphates run closely parallel, and show a tendency to rise during the morning, reaching a maximum after the midday meal, with a slight fall in the following period, and another rise after the evening meal. A minimum is reached during the night. The excretion of phosphates describes a different curve, rising steadily from the middle of the morning until retiring, falling during sleep and continuing to fall for three hours

after rising, reaching a minimum after breakfast. When 64 grams of extra proteid was taken with breakfast, the output of nitrogen began to rise three hours later until the sixth to the ninth hour, when it declined at first rapidly, and then slowly, until it reached the normal in about 36 to 39 hours. The excretion of sulphates runs a similar course; the rise, however, begins a little later, and reaches the normal a little earlier. The increase in the rate of excretion of phosphates begins a little later still, reaches a maximum simultaneously with the nitrogen, and then regains the normal very rapidly in from 12 to 15 hours.

The increased heat of combustion of the urine was but little greater than would correspond with an amount of urea equivalent to the extra nitrogen eliminated. This indicates that the amount of less highly oxidised constituents of the urine was but little affected. The nature and extent of the changes in the urine seem to have been about the same when the proteid was simply added to the diet as when it was substituted for an isodynamic amount of fat. A moderate gain or loss of body nitrogen does not affect the changes noted. W. D. H.

Indicanuria Produced by Administration of Oxalates. By ERICH HARNAACK and ELSE VON DER LEYEN (*Zeit. physiol. Chem.*, 1900, 29, 205—221).—Indicanuria can be produced by poisoning with dilute sulphuric acid (2.5 to 6 per cent. solution), but much more readily and intensely by the administration of oxalic acid by the mouth or subcutaneously. In order to produce this effect, the best form to give is sodium oxalate, and non-toxic doses will accomplish the result; for instance, in a large dog, 0.06 gram given subcutaneously is enough. The indigotin does not apparently arise in the alimentary canal, but as a result of disordered tissue metabolism. W. D. H.

Comparative Investigation of the Fæces after Feeding on Meat and Plasmon. By KARL MICKO (*Zeit. Biol.*, 1900, 39, 430—450).—After feeding on plasmon, the fæces contain no unabsorbed proteids; absorption is stated to be even more complete than after a meat diet. W. D. H.

Organic Phosphorus in Fæces after Feeding on Milk. By PAUL MÜLLER (*Zeit. Biol.*, 1900, 39, 451—481).—By examining the fæces of children fed, some on human, some on cow's milk, no difference between them could be discovered. The N:P ratio was determined by two methods; but the results were practically identical in all cases. The statement made by Knöpfelmacher, that after feeding on cow's milk there is a considerable digestion residue rich in phosphorus in the fæces, was, therefore, not confirmed. W. D. H.

Composition of Urinary Calculi. By LEOPOLD SPIEGEL (*Chem. Centr.*, 1900, 1, 616—617; from *Ber. deutsch. pharm. Ges.*, 9, 318—326).—A large number of analyses of stones removed from various parts of the urinary tract are recorded. W. D. H.

Secretion of Pepsin in Gastric Disease. By ROTH (*Chem. Centr.*, 1900, i, 618; from *Zeit. klin. Med.*, 39, 1—12).—Mett's method (*Diss.*, Petersburg, 1899) is recommended for the clinical estimation of

pepsin in the stomach contents. From a consideration of numerous cases of disease, the estimation of pepsin is considered to have less value for diagnostic than for therapeutic purposes. W. D. H.

[Metabolism in Leucæmia.] By C. VON STEJSKAL and F. ERBEN (*Chem. Centr.*, 1900, i, 828—829; from *Zeit. klin. Med.*, 39, 151—170).—These are chiefly studies in metabolism in various forms of leucæmia. W. D. H.

Physiological Effects of Extracts of Nervous Tissues. By WILLIAM D. HALLIBURTON (*Proc. physiol. Soc.*, 1900, vii—ix; *J. Physiol.*, 25).—Saline extracts of various nervous tissues (fresh and dried) produce a temporary fall of blood pressure, partly by their effect on the heart, partly by causing a dilatation of splanchnic blood vessels. The effect is more marked the greater the proportion of grey matter in the tissue used. The effect is not abolished by section of both vagi, nor, as a rule, by the administration of atropine. The depressor substance is soluble in alcohol, and choline is always to be found in the alcoholic solution. Possibly lactic acid and other substances not yet identified are partly responsible for the effect; these substances will account for the fact that the effect is not always completely neutralised by atropine. It is not advisable to employ glycerol extracts, for glycerol itself has a depressor action. W. D. H.

Physiological Effects of Extracts of Nervous Tissues. By W. A. OSBORNE and SWALE VINCENT (*J. Physiol.*, 1900, 25, 283—294; *Proc. physiol. Soc.*, 1900, ix—x; *J. Physiol.*, 25).—The main results are the same as those recorded in the preceding abstract. The principal difference is the following: although choline is admittedly present in the extracts, its amount is not regarded as sufficient to account for the effect produced, and it is moreover stated that the depressor effect of the extracts is not abolished by atropine. The other substance or substances responsible for the fall of blood pressure were not identified; they are soluble in alcohol and in ether. W. D. H.

Anti-leucocytic Serum; its Action on the Coagulation of Blood. By C. DELEZENNE (*Compt. rend.*, 1900, 130, 938—940).—Certain products of bacterial agency in the blood-serum are believed to hinder coagulation by causing destruction of the leucocytes. Peptone is believed to act in a similar way. The anti-coagulating action of such serum can only be demonstrated by injecting it into the blood stream; *in vitro*, it accelerates coagulation. W. D. H.

Chemical Behaviour of Drugs and Poisons in the Organism. By SIGMUND FRÄNKEL (*Chem. Centr.*, 1900, i, 775—776; from *Pharm. Post*, 33, 109—111).—A discussion on general pharmacological questions, and of the work of others on the subject. W. D. H.

Action of some Aliphatic Compounds. By MÅRTEN ELFSTRAND (*Chem. Centr.*, 1900, i, 560; from *Arch. exp. Path. Pharm.*, 43, 435—455).—Valeraldehyde, pentane, and cyclopentadiene are narcotics like ether, but are not as powerful; cyclopentadiene acts also on muscles,

causing rigor. During the narcosis produced, stimulation of the vagus causes no inhibition of the heart.
W. D. H.

Physiological Action of Nitriles. By EDMOND FIQUET (*Compt. rend.*, 1900, 130, 942—945).—Acetonitrile is less toxic than generally supposed. In rabbits and guinea-pigs, 1.5 c.c. per kilo. of body weight are necessary to cause death rapidly. The higher nitriles are very toxic, and act like certain ptomaines; they produce loss of sensation and muscular paralysis, preceded by convulsions. Very similar effects follow the injection of urine. The influence of the CO_2H and SO_3H groups is to lessen the toxic power of nitriles.
W. D. H.

Action of Santonin and Amyl Nitrite on Vision. By WILHELM FILEHNE (*Pflüger's Archiv*, 1900, 80, 96—107).—In frogs poisoned by santonin and kept in the dark, no departure from the normal is noted in the retinal pigments; but if the animals are kept in the light, and then placed in darkness, there is little or no regeneration of the visual purple, and the melanin-laden epithelial cells show little activity. Amyl nitrite acts in the same way, except that the epithelial cells behave normally in conditions both of light and darkness.
W. D. H.

Action of Caffeine and Theobromine on the Heart. By JOHANNES BOCK (*Chem. Centr.*, 1900, i, 559; from *Arch. exp. Path. Pharm.*, 43, 367—399).—Both caffeine and theobromine cause the isolated mammalian heart to beat more quickly and lessen its elasticity. With large doses, the blood pressure sinks. In rabbits, small doses of caffeine when injected cause a lessening of the heart's rate; this is the result of stimulation of the vagus centre. The rise of blood pressure is due to stimulation of the vaso-motor centre.
W. D. H.

Physiological Action of 1- and 4-Methylxanthines. By MANFREDI ALBANESE (*Chem. Centr.*, 1900, i, 558—559; from *Arch. exp. Path. Pharm.*, 43, 305—310).—The two methylxanthines produce muscular rigor in frogs. 0.01 gram of heteroxanthine or of 1-methylxanthine is lethal; the same dose of 4-methylxanthine only causes slight stiffness. After the injection of methylxanthine, caffeine and theobromine produce little or no tetanus, as they usually do. The lethal dose of 4-methylxanthine in dogs is from 0.3 to 0.4 gram per kilo. of body weight. Smaller doses cause convulsions and affect the breathing, although the heart is still powerful and regular. Heteroxanthine produces no convulsions, but paralysis. With moderate doses of the two methylxanthines, the frequency of the pulse and the arterial pressure go up; with larger doses, although the pulse is still fast, the pressure goes down. In dogs, these substances cause no diuresis, but in rabbits they do. A small quantity of the methylxanthines appears unchanged in the urine.
W. D. H.

Action of Nicotine on Respiration and Circulation. By HEINRICH WINTERBERG (*Chem. Centr.*, 1900, i, 559—560; from *Arch. exp. Path. Pharm.*, 43, 400—434).—In mice and rabbits, nicotine is very fatal, and produces clonic spasms and cessation of respiration.

Smaller doses stimulate respiration. The blood pressure first sinks and then rises.

W. D. H.

Comparative Action of Veratrine Alkaloids on Muscle and Nerve. By AUGUSTUS D. WALLER (*Proc. Physiol. Soc.*, 1899; *J. Physiol.*, 1900, 25).—A frog poisoned by veratrine has muscles that give the well known protracted contraction and nerves that give normal electrical variations in activity. A frog poisoned by proto-veratrine has muscles that give a normal contraction and nerves that give a protracted negative variation.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Production of Quinone by Streptothrix Chromogena and the Biology of this Microbe. By MARTINUS W. BEIJERINCK (*Arch. Neerl.*, 1900, iii, 2, 327—340).—The organism *Streptothrix chromogena*, which is peculiar on account of its capability of causing the formation of quinone, had been previously known to the author as *S. humifica* on account of its playing an active part in the formation of humus in soil; it is probable that both functions are intimately connected. As probably many species exist, the name *S. chromogena Gasperini* is given to the particular microbe examined, and of this, as well as of an allied species, *S. alba*, descriptions are given. It is a minute myceliform vegetation whose spores possess considerable powers of resistance, withstanding water at 80°, but being destroyed at 100°. It is found in soils to the depth of one or two metres, and is abundant in the soil adhering to roots. The author believes the organism to be important to plant life, not only on account of its rapidly converting nitrates into nitrites, and of producing humus, but also probably in aiding the accomplishment of vital processes of which the roots themselves are incapable. The tests are described by which the presence of quinone or of quinhydrone was determined, and the mode of its formation is discussed. It is probably formed from albumin or peptones, as a consequence of catalytic decompositions due to the organisms.

L. M. J.

Action of Fluorescent Substances on Infusoria. By OSCAR RAAB (*Zeit. Biol.*, 1900, 39, 524—546).—In researches on the action of acridine, phosphines, and eosin, daylight was found to increase the destructive influence on infusoria; this is evidently connected with the fluorescence of these compounds. The rays which act most in this way are those which most excite fluorescence, and it is probable that fluorescent substances are able to transform the energy of rays of light into chemical energy. It is also probable that fluorescence plays a part in the animal organism, but in a lesser degree.

W. D. H.

Reactions to Stimuli in Unicellular Organisms. By HERBERT S. JENNINGS (*Amer. J. Physiol.*, 1900, 3, 397—403).—The experiments previously described (this vol., ii, 158) are again discussed, and points

of disagreement with Garrey (*ibid.*) considered. These points are mainly those of nomenclature and interpretation of results.

W. D. H.

Root Nodules of Alder and *Elæagnus*. By LORENZ HILTNER (*Forsil. naturw. Zeit.*, 1898, 7, 415—423).—It was previously shown (*Landw. Versuchs-Stat.*, 46, 153) that, like the *Leguminosæ*, alder plants when provided with root nodules grow normally in absence of combined nitrogen. Some trees have now been growing for five years in sand without nitrogenous manure, and have attained a height of 1·5 metres. Young alder trees grown in ordinary soil continue to grow normally when planted in sand free from nitrogen.

The organism which produces the nodules, *Frankia subtilis*, forms a connecting link between bacteria and fungi. Unlike leguminous plants, alder plants develop normally in water cultures when the nodules remain covered with water (compare this vol., ii, 299). Nodules which seem to be produced by the same organism occur on all varieties of alder.

As regards *Elæagnus*, inoculated plants have grown for seven years without combined nitrogen. Probably all the varieties, such as *Hippophaë* and *Shepherdia*, are enabled, by symbiosis, to utilise free nitrogen (compare Frank, *Ber. deut. bot. Ges.*, 1891, 9, 224.) N. H. J. M.

Assimilation by Means of Chlorophyll. By GINO POLLACCI (*Chem. Centr.*, 1900, i, 822; from *Atti. Inst. Bot. Pavia*, 7, October, 1899. Compare this vol., ii, 160).—The green organs of plants grown in sunlight restore the colour of magenta which has been decolorised by sulphurous acid, whilst fungi or plants which have been kept for a long time in the dark or in an atmosphere free from carbon dioxide do not give this reaction. The distillate obtained by boiling the liquid expressed from plants which have grown in sunlight shows all the reactions of formaldehyde. E. W. W.

Chlorophyllous Assimilation in Indoor Plants. By ED. GRIFFON (*Compt. rend.*, 1900, 130, 1337—1340).—Plant species in general, whether indigenous or cultivated in hothouses, are quite incapable of decomposing carbon dioxide in dimly-lighted apartments; the minimum intensity of illumination at which chlorophyllous assimilation is possible varies for each species. The respiration of certain plants (heather, *Begonia* and *Selaginella*) is so feeble that it is counter-balanced by assimilation even in diffused daylight, and accordingly these species evolve oxygen when cultivated in partly darkened rooms (compare this vol., ii, 159). G. T. M.

Occurrence of Albumin, Albumose, and Peptone in the Vegetative Portions of Plants. By THOMAS BOKORNY (*Pflüger's Archiv*, 1900, 80, 48—68).—The principal references to the literature of this subject from Ritthausen onwards are given. The chief new point made out in an investigation of the soluble proteids in numerous portions of plants of different kinds is that, with the exception of fungi and seedlings, proteoses and peptone are almost altogether absent. W. D. H.

Occurrence of Dulcitol in the Bark of *Evonymus Artropurpureus*. By M. HOEHNEL (*Chem. Centr.*, 1900, i, 869; from *Pharm. Zeit.*, 45, 210—211).—The bark of *Evonymus artropurpureus* has been found to contain dulcitol, but not mannitol. The dulcitol was isolated and identified by its properties and behaviour. E. W. W.

Gummy Substance in Elm Galls. By NAPOLEONE PASSERINI (*Ricerche Esper. Istituto Agrar. Scandicci*, 1896—1897).—The galls of *Ulmus campestris* contain a dense, syrupy liquid which is colourless or slightly yellowish, or more rarely brown. The liquid is slightly alkaline, does not show the tannin reaction with ferric chloride, and is strongly dextrorotatory. Sp. gr. 1.06553 at 21°. It contains 18.94 per cent. of a gum, precipitated by alcohol, which resembles gum arabic in appearance. The gum does not yield mucic acid with nitric acid, or furfuraldehyde when distilled with hydrochloric acid; and it is not coloured by iodine. It is precipitated by lead acetate, and reduces copper salts readily. When oxidised with nitric acid, much tartaric and very little oxalic acid are formed. N. H. J. M.

Distribution of the Diastatic Enzyme in the Potato Plant. By ADOLF MAYER (*Chem. Centr.*, 1900, i, 823—824; from *J. Landw.*, 48, 67—70).—In order to ascertain the distribution of the diastatic enzyme, the amount of diastase in the following materials was approximately determined. (1) Old germinated potatoes, and (2) the sprouts from these potatoes; (3) old potatoes from the field; (4) the young tubers attached to these; (5) the stalks above the ground, and (6) the leaves on these stalks. (1) and (6) were found to contain by far the most diastase, (2) contained very much less, and (3), (4) and (5) were practically free from diastase. Thus, in accordance with the present theory, the organs from which the carbohydrate is sent throughout the plant are the richest in the diastatic enzyme. The old tubers from the field no longer contained diastase, but in this case, the plant being already completely developed and producing abundance of carbohydrate, a supply from the mother tuber was no longer necessary.

Similar experiments made with sugar beet showed that none of the organs contained any enzyme analogous to invertin. In this case, however, the monosaccharides passing through the leaves are not necessarily formed from sugar, and in fact the roots always contain more sugar than the leaves. Experiments with oats show that the ripe seed contains much larger quantities of the diastatic enzyme than the half-ripe ears. E. W. W.

Formation of Vanillin in Potato Parings and its Detection. By W. BRÄUTIGAM (*Chem. Centr.*, 1900, i, 728; from *Pharm. Zeit.*, 45, 164).—Vanillin does not occur in fresh potato parings, but is formed under the influence of warmth and atmospheric oxygen, its formation not being dependent on any bacteriological process. The amount of vanillin formed depends on the temperature, &c., and also on the kind of potato.

Fresh bark taken from a lime tree in summer was found to contain vanillin, but the bark of the same tree in winter was devoid of this substance. E. W. W.

Products in Tobacco Smoke. By HERMANN THOMS (*Chem. Centr.*, 1900, i, 826—827; from *Ber. Deutsch. Pharm. Ges.*, 10, 19—31).—Experiments on the products in tobacco smoke have led to the following conclusions: (1) Tobacco smoke contains the following bases which are injurious to health: nicotine and its decomposition products, pyridine and homologues, and a peculiar, poisonous, ethereal oil which is only formed during the combustion of the tobacco. (2) A solution of alkali not only extracts carbon dioxide and butyric acid from tobacco smoke, but also hydrocyanic acid. The quantity of the last is too small, however, to exercise any physiological influence. (3) The quantity of carbon monoxide in the smoke is also too small to have any deleterious effect. (4) A cigar end may contain as much as 3—4 times the amount of nicotine originally present in the tobacco. (5) Of the total nicotine contained in the smoke, 75 per cent. was isolated as such, whilst 25 per cent. was decomposed. The original paper contains a sketch of an apparatus by means of which products in the smoke of cigars may be examined, 10—15 cigars being sufficient for the test. The amount of nicotine in the cigars is first determined by Keller's method (*Abstr.*, 1899, ii, 193), or by the author's potassium bismuth iodide method. In the latter, which depends on the property of the iodide of precipitating nicotine and organic bases, but not ammonia, 10 grams of the sliced cigars are left in contact with 100 c.c. of 10 per cent. sulphuric acid in a closed vessel for 24 hours at a moderate temperature; to 50 c.c. of the filtered extract, 10 c.c. of potassium bismuth iodide solution (Kraut, *Abstr.*, 1882, 528) are added, the precipitate collected, washed with a little water, and then treated with 20 c.c. of a 15 per cent. sodium hydroxide solution; the alkaline liquid is shaken with 40 c.c. of a mixture of equal volumes of ether and light petroleum, and to 20 c.c. of this extract 10 c.c. of a mixture of equal volumes of alcohol and water and a drop of iodo-eosin solution are added, and the mixture is finally titrated by Keller's method. The percentage of nicotine is found by multiplying the c.c. of decinormal hydrochloric acid used by 0.6480. The pyridine bases are removed by distilling the acetic acid solution in steam, and the nicotine and ammonia left behind are separated by the above method.

E. W. W.

Experiments on the Physiological Phenomena which accompany Chlorosis in the Vine. By GEORGES CURTEL (*Compt. rend.*, 1900, 130, 1074—1076).—The effects of chlorosis are (1) a decided weakening of respiratory activity resulting in a diminution of the relation CO_2/O_2 , (2) a diminution followed by the cessation of the function of assimilation, and (3) a great reduction in transpiratory power. It has been found that the activity of transpiration may be affected by excess of lime in the soil, by excess of water, by unfavourable climatic conditions, &c.

The appearance of chlorosis and the alteration in transpiration seem to be inseparable, and anything capable of modifying the one would necessarily influence the other.

N. H. J. M.

Some Changes produced in Etiolated Plants. By GUSTAVE ANDRÉ (*Compt. rend.*, 1900, 130, 1198—1201).—The composition of

maize and lupin seeds is compared with that of normal and of etiolated plants about six weeks old. The carbon of the etiolated plants amounted to only about half the quantity present in the seeds, whilst there was a slight loss of total nitrogen. The maize seed contained 0.25 gram of asparagine in 100 seeds, and the etiolated plants 0.41 gram; in the case of lupins, the seeds contained 1.51 grams, and the etiolated plants 6.17 grams of asparagine. Amidic nitrogen (including nitrogen as asparagine) represents about half the total nitrogen in etiolated maize, and about nine-tenths the total nitrogen of lupins. These results, in conjunction with those relating to the carbohydrates soluble in water and the carbohydrates saccharifiable by dilute acids, indicate that the regeneration of proteids from asparagine and carbohydrates takes place more readily in maize than in lupins. In etiolated maize, there is a transformation of soluble carbohydrates into cellulose, whilst in the case of etiolated lupins the amount of cellulose remains stationary.

As regards ash constituents, it was found that silica was 30 times as abundant in etiolated maize as in the seed, and 15 times as abundant in the case of lupins. Etiolated maize contained 100 times as much lime as the seeds, but in etiolated lupins the amount of lime remained unchanged. The phosphoric acid both of etiolated maize and lupin plants remained about the same as in the seeds. Potash increased from 0.11 in maize seed to 0.72 in the etiolated plants and diminished from 0.46 in lupin seeds to 0.40 in the plants.

The relatively large amount of lime in etiolated maize plants is perhaps connected with the production of cellulose from soluble carbohydrates.

N. H. J. M.

Chemical Alteration of Rye and Wheat on becoming Mouldy. By R. SCHERPE (*Zeit. Unters. Nahr. Genussm.*, 1900, 3, 166).—With reference to the work of Dietrich, Hebebrand, and Welte, the author points out that grain, flour, and bread must not be regarded as identical media for the growth of micro-organisms.

M. J. S.

Manuring of Clover Hay. By J. R. CAMPBELL (*Rep. Tech. Instruct. Comm. Lancaster C.C.*, 1899, 11—13).—Sodium nitrate and ammonium sulphate applied alone gave almost the same results; but in conjunction with dung, or with a mixture of basic slag and potassium chloride, sodium nitrate gave a considerably greater increase than ammonium sulphate under the same conditions.

With sodium nitrate and basic slag, 1 cwt. of potassium chloride gave better results than half or twice the quantity.

Sodium nitrate, when applied with farmyard manure, produced an increase equal to that when applied alone.

N. H. J. M.

Manuring of Clover Hay. By J. R. CAMPBELL (*Rep. York. Coll. Leeds and E. and W. Ridings Joint Agric. Council*, No. 5, 1900, 8—12).—On chalk soil, potash manures had a decided effect in increasing the yield of red clover; the yellow trefoil was, consequently, largely suppressed. Basic slag alone did not increase the crop, but in conjunction with potassium chloride was decidedly beneficial; a

mixture of the two manures, 4 cwt. and 2 cwt. respectively, is recommended for clover-sick land.

Inoculation with nitragin had no appreciable effect.

N. H. J. M.

Experiments with Horse Beans on Soils of Various Origin under the same Climatic Conditions. By JOSEF SKISSL and EMANUEL GROSS (*Chem. Centr.*, 1900, i, 831; from *Zeit. landw. Versuchs-Wesen. Oesterr.*, 3, 153—162).—The results of pot experiments with six different soils: (1) clayey marl, (2) calcareous clay, (3) poor, red soil, (4) loose, humous loam, (5) sandy loam, rich in humus, and (6) loam poor in sand. No. 4 gave the best results, then 2, 5, 1, and 6 in the order given; No. 3 gave less than half the amount of produce obtained with No. 4.

As regards the plant constituents taken up from the soil, it was found that although the absolute amounts diminished, the relation in which they took part in production remained almost the same.

Analyses of the soil showed that in most cases a certain relation existed between the yield, the assimilation of phosphoric acid, and the proportions of phosphoric acid and sesquioxides on which the solubility of the phosphoric acid doubtless depends.

N. H. J. M.

Composition of the Very Rich Sugar-Beet of the Season 1898. By J. GRAFTIAU (*Ann. Science Agron.*, 1899, [ii], 5, ii, 173—178).—The analysis of a lot of twelve roots gave the following percentage results:

Water.	N.	Fat.	Sucrose.	N-free extract.	Cellulose.	Pure ash.
72.16	0.207	0.047	19.60	5.01	1.216	0.60

The ash contained K_2O , 31.7; CuO , 17.5; MgO , 9.83; and P_2O_5 , 10.17 per cent. The average weight of the roots was 400 grams, and they contained 93.21 per cent. of juice and 6.79 per cent. of marc. Comparing the results with those of previous years, it is seen that although the sugar was abnormally high in 1898 in the fresh roots, the results of this and other years do not differ much as regards sugar in dry matter. The nitrogen, the cellulose, and especially the pure ash, diminish as the sugar increases. As regards the ash constituents, the calcium increases slightly with the sugar, whilst the potassium and phosphoric acid greatly diminish in quantity as the percentage of sugar in the roots increase; and the magnesium remains fairly constant. This is in opposition to Corenwinder's theory that magnesium and phosphoric acid are absorbed in the form of ammonium magnesium phosphate.

N. H. J. M.

Experiments at Rothamsted on the Changes in the Composition of Mangels during Storage. By NORMAN H. J. MILLER (*Journ. Roy. Agric. Soc. Engl.*, 1900, [iii], 11, 57—64).—Samples of mangels from two plots of the permanent Root Crop Field were analysed as soon as possible after being taken up, and subsequently, at suitable intervals, until the end of June. Sugar, total nitrogen, and ash were determined at each date, and pentosans at the commencement

and in June. The results are calculated as percentages of the original weights of the roots (in October).

Series II, Plot I (manured with dung, basic slag, and potassium sulphate). Up to March 28, there was no decided change in composition, either as regards the amount or the nature of the sugar. But by June 20 there was a loss of about 1·4 per cent. of sugar, and about half the sugar had become inverted, whilst the loss of dry matter was about twice as great as that of the sugar; the pentosans diminished from 1·13 in October to 0·82 in June; whilst the total nitrogen at the two dates was nearly the same. There was a gain both of sugar and of nitrogen in the dry matter of the roots.

Series II, Plot II (same manures, with nitrate in addition). In these roots, loss of sugar (0·7 per cent.) had taken place early in January, and there was a further loss (0·66 per cent.) between January 6 and March 28; but from March to June the loss was less. The total loss of sugar in 8 months was 1·7 per cent., whilst the loss of total organic matter was 2·2 per cent. The inversion of the sugar began earlier, but was not so great as in Series II, Plot I. The percentage of pentosans was 0·97 in October, and 0·72 in June. The dry matter of the roots contained less sugar in June than in October, and rather more nitrogen.

In comparing the results obtained with the roots from the two plots, it is seen that the loss of sugar was greater and the loss of organic matter other than sugar much less under the influence of nitrate than without nitrate; in the one case, there was a tendency for the percentage of sugar in the dry matter to diminish and in the other to considerably increase.

As regards pentosans, the roots manured with nitrate contained rather less than the roots which received no nitrate (compare de Chalmont, *Ber.*, 1894, 27, 2722); and the loss was slightly less in the case of the nitrate plot.

Calculated in pounds per acre, it is seen that the loss of sugar was very considerable, especially in the case of the roots from Series II, Plot II. Owing, however, to the much greater yield of roots on this plot, the amount of sugar from the roots of an acre remained much in excess of the amount from Series II, Plot I. N. H. J. M.

Behaviour of Water-soluble Phosphoric Acid in Soils. By MARTIN ULLMANN and A. GRIMM (*Chem. Ind.*, 1900, 23, 61—69).—The results of numerous experiments with various soils showed that for months after the application of superphosphate, phosphoric acid soluble in water passed through a depth of soil equal to 25—27 cm. without being completely retained, either chemically or mechanically. It is not possible by determining the magnesia, lime, and sesquioxides in soil to estimate its absorptive power for phosphoric acid, as the results cannot show to what extent these substances are available. An artificial mixture of sand (300 grams) and freshly precipitated aluminium hydroxide (3 grams) completely absorbed 0·15 gram of soluble phosphoric acid at once, whilst with ferric hydroxide the absorption was complete in an hour. With soil (100 grams) containing 10·26 per cent. of ferric oxide and alumina, and 0·18 gram of

soluble phosphoric acid, 28.13 per cent. of the latter remained in solution after 66 hours, only a portion of the sesquioxides being available for fixing phosphoric acid.

In the case of soil containing 18.7 per cent. of lime as carbonate, in addition to 4.21 per cent. of ferric oxide and alumina, 20.24 per cent. of the soluble phosphoric acid remained dissolved after 66 hours, and 18.81 per cent. after 14 days.

The diffusion of water-soluble phosphoric acid in the soil depends on the amount and distribution of the rain. There is no evidence to show how far the fear of loss of soluble phosphoric acid in light, sandy soils is justified, but in the case of limed or marled sandy soil it has been shown that no loss takes place. The mechanical fixation of soluble phosphoric acid seems to depend on the amount of fine sand, and especially sand of the fineness of dust, in the soil.

Attention is called to the advantage of a supply of soluble phosphoric acid in the subsoil, and the conclusion is drawn that superphosphate is, in many cases, preferable to other phosphatic manures.

N. H. J. M.

Chemical Methods for ascertaining the Lime Requirement of Soils. By HENRY J. WHEELER, BURT L. HARTWELL, and C. L. SARGENT (*J. Amer. Chem. Soc.*, 1900, 22, 153—177).—The best method, of those tried, for ascertaining the lime requirement of upland acid soils in Rhode Island was found to be titration with ammonia. The soil (15 grams) is treated with about *N*/10 ammonia (100 c.c.) and distilled water (100 c.c.) and frequently agitated during about 42 hours. After being allowed to settle, a definite amount of the liquid is treated with hydrochloric acid (about *N*/2) at the rate of 5 c.c. to each 20 c.c. of solution, and made up to a definite volume. When the precipitated humus has settled, portions of 50 c.c. are titrated with ammonia, coralline being employed as indicator. The method is most suitable in the case of soils containing much humus. The gravimetric determination of humus in soils, without previous extraction with acid, also gave results more in accordance with the crop tests than the other methods.

Useful indications are obtained by observing the effect of the moistened soil on blue litmus paper, as compared with soil of known character; and (when the acidity is due to a great extent to organic matter) by treating the soil with dilute ammonia, and noting whether the liquid acquires a dark brown or black colour.

In the case of the upland acid soils, the methods of Hollemann (extracting the lime with water containing carbon dioxide, *Landw. Versuchs-Stat.*, 1892, 41, 38), and of Tacke (*Abstr.*, 1898, ii, 103), and extracting the lime with hot dilute hydrochloric acid, were found to be unsuitable. A new method, which it is thought may prove to be very useful when the most suitable conditions have been ascertained, is described, in which the soil is heated with calcium carbonate in presence of water and the carbon dioxide determined.

N. H. J. M.

Composition of the Soils of the Canton Redon as regards Lime, Magnesia, Potash, and Nitrogen. By G. LECHARTIER (*Compt. rend.*, 1900, 130, 1163—1166).—Analyses of soil samples re-

presenting the soils of different geological origin in the Canton of Redon, in the Department Ille-et-Vilaine, are given. The formations from which the various soils are derived are granite, pre-Cambrian, Silurian, Upper Silurian, and ancient and modern alluvium. The average amounts of lime and magnesia are 0.58—1.08 and 0.84—1.60 per thousand. In some cases, soils which produce 20—30 hectolitres of wheat per hectare contain only 0.26—0.28 per thousand of lime on the pre-Cambrian, and 0.67—0.80 per thousand on the Angers schists. The soils are rich in potash, and only on 6—7 per cent. of the whole area is the amount of potash in the soil less than 0.2 per cent.; the average amounts are 0.232—0.577 per cent.

The soils contain on the average 0.109—0.135 per cent. of nitrogen, and 2.37—4.18 per cent. of organic matter, determined by Raulin's method.

N. H. J. M.

Arable Soils of the Canton of Redon with respect to Phosphoric Acid. By G. LECHARTIER (*Compt. rend.*, 1900, 130, 1225—1229. Compare preceding abstract).—The cultivated soil of half the area of the Canton contains more than 0.1 per cent. of phosphoric acid. The average amounts of phosphoric acid in the soils derived from the different geological formations are as follows: granite, 0.87; pre-Cambrian, 0.90; Armorican sandstone, 0.57; Angers schist, 1.04; Poligné schist and sandstone, 1.05; and alluvium, 1.24 per cent.

Phosphatic manuring was found to be beneficial even in the case of soils containing more than 0.1 per cent. of phosphoric acid. Both the yield and the quality of wheat, grown in rotation, was benefited by phosphates; and fossil phosphates and basic slag had more effect than superphosphate.

N. H. J. M.

Analysis of Siberian Arable Soil. By A. SEMPOLOWSKI (*Chem. Centr.*, 1900, i, 831; from *Zeit. landw. Versuchs-Wesen Oester.*, 3, 163—164).—The sample of soil was obtained from the steppe near Omsk, where the land had been ploughed once. The soil contained: Stones, 0.014; coarse gravel, 0.046; fine gravel, 1.050; coarse sand, 1.362; fine sand, 13.630; sand as dust, 55.115; and clay, 28.773 per cent. The chemical composition of the dry soil was as follows: Humus, 11.57; N, 0.57; K₂O, 0.16; CaO, 0.93; and P₂O₅, 1.00 per cent. The absorptive power for water is 35.84 per cent.

Experiments with sugar beet gave unsatisfactory results; the roots were small, and the juice had a very low purity coefficient.

N. H. J. M.

Use of Nitragin and Alinit for the Growth of Beans and Oats respectively. By J. R. CAMPBELL (*Rep. Tech. Instruction Comm. Lancaster C.C.*, 1899, 36—37).—Experiments with beans and clover made in 1897 seemed to indicate that inoculation with nitragin was beneficial. In 1898, negative results were obtained.

Alinit had no apparent effect.

N. H. J. M.

Experiments with Alinit. By HJALMAR VON FEILITZEN (*Mitt. Ver. Förd. Moorkultur*, 1900, 18, 41—44).—Black Tartarian oats were

grown in peaty soil in zinc vessels having an area of 0.283 sq. m. All the vessels received slaked lime (6000 kilos.), basic slag (800 kilos.), and potash manure (96 kilos. per hectare); one set had no further manure, another had alinit, and a third set nitrogen as ammonium sulphate and sodium nitrate. The following yields were obtained (grams):

Kainit.			88 per cent. potash manure.		
Without N.	Alinit.	With N.	Without N.	Alinit.	With N.
167.5	156.0	434.0	133.5	123.5	369.0

Field experiments on peat land furnished similar results; both the yield of grain and of straw were much less under the influence of alinit than without alinit, whilst sodium nitrate very greatly increased the yield.

In field experiments on poor, sandy soil, the effect of inoculation with alinit was compared with that of different amounts of sodium nitrate. The smallest amount of nitrate (100 kilos.) produced considerably more grain and straw than was obtained on the alinit plot.

N. H. J. M.

Alinit. By BRUNO TACKE (*Mitt. Ver. Förd. Moorkultur* (1900, 18, 37—41).—Oats, barley, and summer rye were grown in peaty soil in pots, without nitrogenous manure, with sodium nitrate and with alinit respectively. Mineral manures were applied to all the pots. Similar experiments were also made on plots.

In the case of the pot experiment, the application of alinit resulted, on the whole, in a slightly diminished yield, owing possibly to denitrification. In the field experiments with rye, barley, and oats, the yield was considerably less under the influence of alinit than on the plots which were not inoculated, whilst nitrate, in every case, increased the yield. In the case of black oats, the yield of the alinit plot was greater than that of the plot which had no alinit, but much less than that of the nitrate plot. It is, however, not thought that the alinit had any beneficial effect.

N. H. J. M.

Analytical Chemistry.

Apparatus for Measuring Evolved Gases at Constant Volume. By ANDRÉ JOB (*Bull. Soc. Chim.*, 1900, [iii], 23, 288—291).—This apparatus is of use in the analysis of carbonates, carbides, sulphides, carbamide, &c., the gases evolved by the decomposition of these substances in a closed vessel being estimated by the increase in pressure observed. It consists of a bulb or flask, connected with a delicate mercurial manometer, into the neck of which fits a graduated pipette furnished with a stopper so arranged that the liquid run into the flask is replaced by the air in the apparatus itself. Before each experiment, the apparatus is brought to a known temperature by im-

mersion in water, and the pressure made equal to that of the atmosphere; the acid or other liquid in the pipette is then allowed to flow into the flask, which may be heated if necessary, and the apparatus finally brought to the original temperature and the manometer read. If h is the increase in pressure, V the capacity of the apparatus, and t the temperature, the volume of the gas evolved is $Vh/760(1 + \alpha t)$.

N. L.

Hydro-Gasometer and Urinometer. By E. BENOIT (*J. Pharm.*, 1900, [vi], 11, 454—458).—The apparatus consists of a bottle (A) closed with a cork through which a tube passes. This tube is connected to another tube which passes through a cork inserted in one neck of a three-necked Woulff's bottle. Through the cork in the second neck of the Woulff's bottle, a thistle funnel is inserted, to act as a safety tube, and through the cork in the third neck a tube bent twice at right angles is inserted; one end of this tube dips under the water contained in the Woulff's bottle. The gas evolved in the bottle (A) forces the water out of the Woulff's bottle, and by collecting this water in a graduated cylinder, the volume of the gas evolved is ascertained.

H. R. LÉ S.

New Electrodes for Electrolytic Estimations. By AUGUSTE HOLLARD (*Bull. Soc. Chim.*, 1900, [iii], 23, 291—292).—The electrode on which the element is to be deposited consists of a nearly cylindrical, truncated cone of platinum foil, whilst the other electrode consists of a spiral of platinum wire inside, and a wire cage outside, the cone. The advantages claimed are rapid and regular deposition, and an equable evolution of gas, whereby loss through spirting is avoided.

N. L.

A New Indicator. By JULIUS FORMÁNEK (*Zeit. anal. Chem.*, 1900, 39, 99—103).—Alizarin-green-B (Dahl and Co.) dissolves in water with a dirty green colour; in alcohol, more sparingly, with a flesh colour. Acids added to either of these solutions produce a carmine red colour, alkalis a pure green. It is affected by carbon dioxide as by an acid. In presence of ammonium salts, its indications are uncertain. Aluminium salts behave like free acids, even in presence of precipitated aluminium hydroxide. This indicator can be used by artificial light. M. J. S.

New Indicator for Acidimetry; Estimation of Boric Acid. By JULES WOLFF (*Compt. rend.*, 1900, 130, 1128—1131).—Ferric salicylate dissolved in a solution of sodium salicylate develops a violet coloration in dilute mineral acids, which changes to orange when the solutions are neutralised or rendered alkaline by sodium hydroxide; the acid reaction is, however, not produced by boric, phosphoric, or hydrofluoric acid, and the end point is not affected by the presence of ammonium sulphate. Similar reagents may be obtained from other aromatic ortho-hydroxy-acids.

In estimating the boric acid present in a borate, the solution of the salt is acidified with sulphuric acid, and the excess of mineral acid removed by means of standard alkali, the end point being determined by the above indicator. Glycerol and phenolphthalein are now

added to the solution, and the titration of the boric acid is effected in the usual manner (compare this vol., ii, 312).

G. T. M.

Iceland Spar as a Standard in Volumetric Analysis. By ORME MASSON (*Chem. News*, 1900, 81, 73—75).—Iceland spar in lumps of a gram to three grams in weight, freed from dust and sharp edges by treating with dilute hydrochloric acid, and then washing and drying, is used in quantities of about 3 grams; it is weighed in the beaker, which is covered with a glass. Twenty c.c. of the acid to be tested are run in, and when action has ceased, the sides and cover of the beaker are washed down, and the whole heated to and kept at boiling temperature for an hour. The calcium chloride solution is decanted off, the beaker and residual spar well washed, dried, and weighed. The strength of the acid is calculated from the loss in weight.

D. A. L.

Separation and Identification of Acids. By RICHARD ABEGG and W. HERZ (*Zeit. anorg. Chem.*, 1900, 23, 236—239).—The authors give a systematic method for the qualitative examination of the acids of a mixture, analogous to those in general use for the bases. The substance is (i) boiled with dilute hydrochloric or nitric acid, whereby carbon dioxide, sulphur dioxide, nitrogen trioxide, hydrogen cyanide, hydrogen sulphide, and acetic acid are evolved, and are identified by special tests. (ii) The substance is boiled with concentrated sodium carbonate solution, the filtrate treated with hydrochloric acid, made alkaline with ammonia, and treated with calcium chloride. A precipitate insoluble in acetic acid indicates the presence of a fluoride or oxalate; a precipitate soluble in acetic acid indicates the presence of a cyanide, succinate, arsenite, arsenate, or phosphate. (iii) The filtrate from (ii) is treated with barium chloride. A precipitate soluble in hydrochloric acid indicates the presence of a chromate or dichromate; a precipitate insoluble in hydrochloric acid indicates the presence of a sulphate or silicofluoride. (iv) The filtrate from (iii) is neutralised with hydrochloric acid and zinc chloride added. A brownish-yellow precipitate indicates the presence of a ferricyanide, and a white precipitate the presence of a ferrocyanide. (v) A small quantity of the filtrate from (iv) is treated with a small quantity of a ferric salt. A permanent red coloration indicates the presence of a thiocyanate, and a red coloration disappearing on boiling with the formation of a precipitate the presence of an acetate. (vi) In the absence of a thiocyanate, the filtrate from (iv) is treated with a solution of silver nitrate (nitric acid and nitrates being used in place of hydrochloric acid and chlorides in all previous operations). A precipitate indicates the presence of a chloride, bromide, or iodide. (vii) An aqueous solution of the original substance is tested for a nitrate by means of a ferrous salt. Oxyhalogen acids are indicated by the evolution of oxygen on igniting the original substance.

E. C. R.

Volumetric Estimation of Bromides in Presence of Iodides and Chlorides. By JULIUS VON WESZELSZKY (*Zeit. anal. Chem.*, 1900, 39, 81—91).—In moderately acidified solutions, hydriodic acid is converted into iodic acid by chlorine, whilst from hydrobromic acid

the bromine separates in the free state. In alkaline solutions, bromides are oxidised to bromates. A mixture, containing the three halogen salts, is therefore acidified, treated with chlorine water, and distilled in a stream of carbon dioxide into a solution of potassium hydroxide. The retort with a bulbous neck, employed by Bunsen and Fresenius for the absorption of chlorine, forms a suitable receiver; the still should consist entirely of glass. When the carbon dioxide is no longer absorbed, the contents of the receiver are boiled to dryness to expel chlorine and hypochlorous acid, and convert hypochlorite entirely into chlorate. The residue is dissolved, mixed with some potassium iodide and acidified, and the liberated iodine titrated with thiosulphate. The iodate in the still can also be estimated by adding potassium iodide and titrating the iodine. In the absence of iodides, potassium carbonate and chlorine are added to the original solution, which is then boiled down and treated as before. Arsenic and antimony must first be removed by hydrogen sulphide, and iron, by boiling with the alkaline carbonate and filtering before adding chlorine. M. J. S.

Estimation of Ozone. By NICOLAE TECLU (*Zeit. anal. Chem.*, 1900, 39, 103—105).—The gas in which ozone is to be estimated is enclosed in a glass tube of pipette form between two stopcocks. A solution of potassium iodide is forced into the tube by mercury pressure, and shaken with the gas for 5 minutes. It is then acidified with acetic acid to decompose any iodate which has been formed, and is titrated with thiosulphate. Any blue colour which is developed after its first disappearance is to be neglected. 1 c.c. of *N*/100 thiosulphate = 0.00008 gram of ozone. M. J. S.

Detection of Sulphates in Presence of Thiosulphates. By LEONARD DOBBIN (*Pharm. J.*, 1900, [iv], 10, 182).—Barium sulphate is perceptibly soluble in solution of sodium thiosulphate, especially in the presence of a little free nitric acid.

Salzer has recommended converting the thiosulphate into tetrathionate by means of iodine before testing for sulphate, but the author thinks that the detection of sulphate is best accomplished by using the method devised by Grossman. The liquid is heated in a current of carbon dioxide, hydrochloric acid is added, and the sulphur dioxide expelled by prolonged boiling. The remaining liquid is filtered and tested for sulphate with barium chloride. L. DE K.

Estimation of Nitric Nitrogen by Schlösing's Method. By C. DAVIDSON (*Chem. News*, 1900, 81, 97—98).—A modification of de Koninck's apparatus (*Abstr.*, 1894, ii, 296) is described; in it a descending tube, 800 mm. long and 2 mm. bore, is used to connect the distilling flask to the lower side tube of a modified Schiff's nitrometer, the lower part of which is charged with mercury nearly to the level of the other side tube, which is connected with an air-free water supply. The gas burette is furnished with a T-piece at the top, to the middle limb of which the top of the modified Schiff nitrometer is attached by means of a capillary tube, the other limb carrying a funnel with a clip at the connection. In use, air is driven out from the intermediate vessel and at this funnel by the air-free water; the

gas burette is charged from its reservoir with soda right into the funnel, and subsequently the intermediate vessel and the gas burette are put into connection for the transference of the nitric oxide produced.

D. A. L.

Detection of Nitrous Acid in Water by Means of Aminonaphthol-K-Acid [1-Amino-8-hydroxynaphthalene-4:6-disulphonic Acid]. By H. MENNICKE (*Zeit. angew. Chem.*, 1900, 235—236).—The author strongly recommends Erdmann's process (this vol., ii, 243) as affording the most delicate test as yet known for the detection of nitrites in drinking water. Nitrites do not interfere. It is possible to detect the presence of 1 part of sodium nitrite in 300,000,000 parts of water. The test is best made in daylight.

L. DE K.

Detection of Nitric Acid in Water and in Milk. By F. UTZ (*Chem. Centr.*, 1900, i, 875; from *Pharm. Zeit.*, 45, 229—230).—Cimmino's modified diphenylamine test is recommended if conducted in the following manner. The water or the milk serum is mixed with a little of the diphenylamine reagent, put into a test-tube, and strong sulphuric acid is carefully poured down the side. At the place of contact a more or less intense blue ring is formed. When milk is kept for a long time, the lactic acid bacteria destroy any nitrates.

L. DE K.

Hygienic Significance of Nitrites in Drinking Water. By EDUARD SCHAEER (*Ber.*, 1900, 33, 1232—1236).—A theoretical paper, in which the author discusses the origin of nitrites in drinking water, and endorses Spiegel's conclusion (this vol., ii, 318) as to their being of little value for hygienic diagnosis; no new facts are adduced.

W. A. D.

Connection Between the Chlorides and Nitrates in the Polluted Well Waters in Inhabited Localities. By JOSEF KÖNIG (*Zeit. Unters. Nahr.-Genussm.*, 1900, 3, 228—233).—Attention is directed to the already well-known fact that in well waters which have been contaminated with sewage there is generally an intimate relation between the chlorides, nitrates, and sulphates present. Waters which are unquestionably free from animal pollution may contain large amounts of one or other of these impurities, and even be very rich in bacterial life, but the simultaneous presence of large proportions of all of them, if the conditions as to locality are such that contamination is possible, point unmistakably to its occurrence.

M. J. S.

Estimation of Arsenic in Metals and Alloys. By AUGUSTE HOLLARD and L. BERTIAUX (*Bull. Soc. Chim.*, 1900, [iii], 23, 300—302).—The arsenic is separated by distillation with hydrochloric acid and ferric sulphate, and titrated with iodine solution in the usual manner. Antimony is retained by passing the vapours through a U-tube filled with glass beads and heated in an oil-bath at 150—175°. The process is inexact when applied to the estimation of arsenic in antimony, since about 0.03 per cent. of the latter passes over into the distillate.

N. L.

Detection of Boric Acid in Borates. By HUGO BORNTÄGER (*Zeit. anal. Chem.*, 1900, 39, 92).—When heated on platinum foil, boric acid colours a Bunsen flame green; borates do not. Borates when similarly heated with hydrofluoric acid or with ammonium nitrate and chloride, or with mixtures of sulphuric and hydrochloric acids, sulphuric and nitric acids, or hydrochloric and nitric acids (but not with one of the acids alone) give an instantaneous and intense green coloration. The reaction is more sensitive than that with sulphuric acid and alcohol. M. J. S.

Absorption Apparatus for Elementary Organic Analysis. By FRANCIS G. BENEDICT (*Amer. Chem. J.*, 1900, 23, 323—334).—The water formed during a combustion is absorbed by bubbling through concentrated sulphuric acid contained in the bend of a 5" U-tube, the second limb containing glass-wool moistened with the same acid to finally dry the gas; any condensed water is allowed to drop into a small vial supported in the first limb above the acid on a piece of glass rod flattened at one end. The carbon dioxide is absorbed in a U-tube by specially prepared moist soda-lime, whilst another U-tube acting as a guard tube, is one-third filled with soda lime and two-thirds with pumice moistened with concentrated sulphuric acid, a plug of glass wool separating the two. The advantage of this apparatus over that ordinarily employed is discussed; a description is appended of a modified calcium chloride jar, which serves to free the air or oxygen used in a combustion from both water and carbon dioxide in a single vessel. W. A. D.

Estimation of Carbon and Hydrogen by Combustion in Oxygen using Copper Oxide. By CHARLES F. MABERY and WILLIAM R. CLYMER (*J. Amer. Chem. Soc.*, 1900, 22, 213—218).—From the authors' experiments, it appears that the best results in the analysis of hydrocarbons are obtained when the combustion tube containing the copper oxide has been used a few times.

The water formed during the combustion is best absorbed in a U-tube containing 3 c.c. of strong sulphuric acid, a bulb being attached to condense the greater part of the water; the quantity of carbon dioxide retained by the acid is very trifling. The carbon dioxide is best absorbed in a Geissler apparatus containing aqueous potassium hydroxide of 33.3 per cent. strength, the usual calcium chloride tube being attached; no advantage is gained by using phosphoric oxide instead of fused calcium chloride.

The air and oxygen used in the experiment should be purified by passing through two long bent tubes containing broken glass moistened with 40 per cent. aqueous potassium hydroxide and strong sulphuric acid respectively. L. DE K.

Elementary Analysis of Organic Substances containing Nitrogen. By FRANCIS G. BENEDICT (*Amer. Chem. J.*, 1900, 23, 334—352).—When a substance containing nitrogen not directly combined with oxygen is first charred in the closed combustion tube (that is, without a current of air or oxygen), and the non-volatile residue subsequently oxidised by the admission of oxygen, no oxides of

nitrogen are produced; in the case, however, of nitro-compounds, and especially of nitrates of organic bases, the results are vitiated by the formation of these oxides. Instead of employing a copper spiral in the fore-part of the tube to reduce the oxides, the author mixes with the substance analysed a known weight of either pure cane sugar (in the form of powdered sugar-candy) benzoic acid, or naphthalene; the finely-divided copper produced in the reduction of the copper oxide by this excess of oxidisable material is sufficient to completely reduce any oxides of nitrogen formed. This method obviates the error usually introduced in a combustion owing to the presence of either hydrogen, water, or carbon dioxide in the copper spiral employed. In the case of explosive compounds, the combustion is rendered more regular by mixing the substance with 3 or 4 times its bulk of finely powdered, pure quartz. In the case of highly nitrated substances, it is noteworthy that this admixture has a direct influence on the reduction of nitrogen oxides; although not completely reduced, these are now present in much smaller quantities, so that without the addition of a reducing material such as cane sugar or benzoic acid, the results obtained for carbon are sufficiently accurate for most purposes, although the percentage of hydrogen is somewhat too high.

A large number of analyses are given showing the universal application of the method described, and the degree of accuracy of the results obtained.

W. A. D.

Repeated Use of Copper Potassium Chloride for the Solution of Steel or Iron in estimating Carbon. By GEORGE W. SARGENT (*J. Amer. Chem. Soc.*, 1900, 22, 210—213).—The solution of copper potassium chloride, when used in the estimation of carbon in steel or iron, gradually becomes converted into the cuprous state, but may be rendered again fit for use by passing a current of chlorine. In this way, it may be used over and over again until it becomes too saturated with iron.

L. DE K.

Direct Combustion of Metallic Alloys. By HARRY BREAULEY (*Chem. News*, 1900, 81, 91—92).—With regard to the direct estimation of carbon in alloys, &c., in the case of tungsten, ferro-tungsten (85 and 50 per cent.), ferro-silicon, 12 per cent. silicon-spiegel, ferro-silico-molybdenum, molybdenum, and 70 per cent. molybdenum-nickel, satisfactory decarbonisation has been achieved by 1 hour's combustion of the material passed through a 90-mesh sieve, in a current of oxygen at a high temperature, a porcelain tube supported on asbestos arches being employed. With 20 per cent. spiegel, 70 per cent. tungsten-nickel, 80 per cent. ferro-manganese, 60 per cent. ferrochromium, 70 per cent. chromium-nickel, and chromium, however, decarbonisation was imperfect under the same circumstances.

D. A. L.

Substitutes for Hydrochloric Acid in Testing Carbonates. By JOSEPH W. RICHARDS and NORMAN S. POWELL (*J. Amer. Chem. Soc.*, 1900, 22, 117—121).—For use in the field, the authors prefer using solid acids for the identification of native carbonates as being more easy to carry in a portable set of apparatus. Before use, they are dissolved in boiling water.

A 20 per cent. solution of tartaric acid is the best, citric acid coming next. A 10 per cent. solution of oxalic acid does not give such a plain effervescence as the others. A 20 per cent. solution of potassium hydrogen sulphate also gives a satisfactory result except in the case of witherite and phosgenite; it must be remembered that sulphides also give effervescence.

L. DE K.

Technical Estimation of Zinc. By ALBERT H. LOW (*J. Amer. Chem. Soc.*, 1900, 22, 198—202).—The author's process is devised for zinc ores from Colorado, but with suitable modifications it may no doubt be applied also to other zinc ores.

A solution of potassium ferrocyanide containing 22 grams of the crystallised salt per litre is standardised by dissolving 0.1 gram of pure zinc in 6 c.c. of strong hydrochloric acid, and adding 10 grams of ammonium chloride and 200 c.c. of boiling water. The ferrocyanide is then added until a drop of the liquid strikes a brownish colour with solution of uranium nitrate.

0.5 gram of the ore is boiled in a pear-shaped flask with 5 c.c. of nitric acid and 2 grams of potassium nitrate, 10 c.c. of a saturated solution of potassium chlorate in nitric acid are added, and the whole evaporated to complete dryness. When nearly cold, 30 c.c. of a solution containing 200 grams of ammonium chloride, 350 c.c. of water, and 500 c.c. of ammonia are added, and the contents boiled for 2 minutes; the solution is filtered and the undissolved matter washed with a hot solution of ammonium chloride containing 100 grams of the salt and 50 c.c. of ammonia to the litre. The filtrate is neutralised with hydrochloric acid, and 6 c.c. of the latter are then added in excess. After diluting to about 150 c.c., any copper, cadmium, and the bulk of the lead are precipitated by adding 50 c.c. of a saturated solution of hydrogen sulphide. After filtering, which is, however, only necessary if there is an abundant precipitate, the liquid is heated, and about one-third is poured into a beaker and set aside. The remainder is then titrated as described, and the greater part of the reserve liquid being added, the titration is continued; finally, the remainder of the reserve liquid is added and the titration cautiously finished. Both in this titration and in the "check," the true end-point is always slightly passed, as it always requires one or more drops of the ferrocyanide solution to get the uranium reaction, but this may be ascertained by a direct experiment.

Attention is called to the great importance of carefully following the directions as to the amount of free acid. Arsenic, when present in large amount, sometimes gives trouble by retaining iron in the ammoniacal solution. In this case, the ore should be subjected to a preliminary treatment. 0.5 gram of the sample is treated with 10 c.c. of strong hydrochloric acid and 1 c.c. of bromine, gently warmed for a few minutes, and finally boiled to dryness; the arsenic will thus be sufficiently expelled. Potassium nitrate and nitric acid are added, and the analysis proceeded with in the usual manner.

With some ores, it may be necessary to resort to a fusion before dissolving in acid.

L. DE K.

Volumetric Estimation of Red Lead. By JAMES F. TOCHER (*Pharm. J.*, 1900, 10, 310—312).—*1st Method.*—2.064 grams of the sample are heated with 50 c.c. of nitric acid of sp. gr. 1.2; 50 c.c. of *N/5* solution of oxalic acid are added, and when the lead peroxide has disappeared, the liquid is partly neutralised with barium hydroxide. Solution of sodium sulphate is now added to precipitate the lead and barium, and after adding some dilute sulphuric acid to decompose any barium oxalate, the excess of oxalic acid is titrated with *N/5* permanganate. One c.c. of oxalic acid decomposed by the lead peroxide represents 3.3 per cent. of red lead.

The matter may be simplified by treating the sample with 50 c.c. of nitric acid of sp. gr. 1.3 and adding the oxalic acid from a burette until the last trace of lead peroxide has disappeared.

2nd Method.—3.415 grams of the sample are heated with hydrochloric acid, the chlorine evolved is passed through a solution of potassium iodide, and the liberated iodine is titrated with *N/10* sodium thiosulphate; each c.c. represents 1 per cent. of red lead.

3rd Method.—1.032 gram of the sample is heated with 20 c.c. of *N/5* nitric acid and 20 c.c. of neutral hydrogen peroxide in a retort, the drawn-out neck of which dips into *N* soda, which should not be in excess. When the lead peroxide is decomposed, the flame is removed, and the soda solution allowed to enter the retort. Excess of sodium sulphate is added, then phenolphthalein, and the free nitric acid titrated with normal soda. Ten times 100 (representing 20 c.c. of *N/5* nitric acid) — number of c.c. of soda required for neutralisation, gives the percentage of total lead in the sample. If only the lead peroxide is to be estimated, the sample is first treated with dilute nitric acid, and the undissolved matter is collected on a filter; or the decomposed mixture is carefully poured on to a saturated solution of sodium and potassium nitrates, contained in a conical vessel, when the lead peroxide sinks to the bottom, and the acid liquid may be siphoned off; the deposit is then treated with hydrogen peroxide as directed.

L. DE K.

Estimation of Thallium. By VICTOR THOMAS (*Compt. rend.*, 1900, 130, 1316—1319).—Soluble thallous salts are oxidised to the thallic condition, by auric bromide (bromauric acid, HAuBr_3), an equivalent amount of gold being precipitated; the latter is collected and weighed. The amount of thallium present is obtained by multiplying the weight of this precipitate by the factor 1.5533. The quantity of thallous compound taken for analysis should correspond with 0.2—0.3 gram of the pure chloride.

The auric bromide is conveniently prepared by dissolving gold in a mixture of bromine and hydrobromic acid, and evaporating the solution to the crystallising point.

G. T. M.

Analysis of Commercial Copper. By AUGUSTE HOLLARD (*Bull. Soc. Chim.*, 1900, [iii], 23, 292—300).—A detailed scheme for the complete analysis of commercial copper is given. The metal is dissolved in a mixture of sulphuric and nitric acids, and the copper, together with silver, deposited electrolytically, using the author's

form of electrodes (this vol., ii, 435). Since arsenic and antimony are usually present in sufficient quantity to be deposited along with the last traces of copper, it is advisable to stop the electrolysis before the whole of the copper is deposited, and to estimate the remainder after removing arsenic and antimony. The arsenic is precipitated by hydrogen sulphide in concentrated hydrochloric acid solution, and the filtered liquid diluted with an aqueous solution of hydrogen sulphide, whereby the sulphides of copper and antimony are precipitated. The mixed sulphides are dissolved in potassium cyanide solution, and the antimony estimated electrolytically, whilst the residual copper is estimated colorimetrically or electrolytically after removal of the cyanide. In the liquid from which copper, arsenic, and antimony have been removed, the iron is precipitated by ammonia, and the precipitate dissolved in hydrochloric acid and titrated with iodine solution. The nickel and cobalt still remaining in solution are deposited electrolytically in presence of ammonium sulphate, according to Fresenius and Bergmann's process. For the estimation of lead a fresh quantity of the metal is dissolved in nitric acid, and the solution electrolysed, the lead being deposited as peroxide on the anode. The electrolytically deposited copper, or a fresh portion of the original metal, is dissolved in nitric acid, and the silver precipitated by hydrochloric acid; the precipitate is dissolved in potassium cyanide solution and the liquid electrolysed, the metal being either weighed as such, or dissolved in nitric acid and titrated with potassium thiocyanate solution. Arsenic is estimated by the Hollard and Bertiaux's process (this vol., ii, 438). Gold is determined by treating a large quantity of the metal with nitric acid and cupelling the insoluble residue. Sulphur is estimated as barium sulphate in the nitrohydrochloric acid solution of the metal. N. L.

Volumetric Estimation of Corrosive Sublimate in Dressing Materials. By MARTIN LEHMANN (*Chem. Centr.*, 1900, i, 876; from *Pharm. Zeit.*, 45, 209—210).—Twenty grams of the material are treated in a 500 c.c. stoppered flask with 200 c.c. of a 0.5 per cent. solution of sodium chloride at 70—80°, and left for 24 hours at 25—30°, with frequent shaking; 100 c.c. of the solution are then carefully evaporated to 10—15 c.c. A loss of mercuric chloride is not to be feared, as its double sodium salt is not volatilised with water vapour. The solution is now slowly poured into 20 c.c. of *N*/100 alkali, the mixture is gently warmed, and the excess of alkali titrated with *N*/100 hydrochloric acid, using phenolphthalein as indicator. L. DE K.

Estimation of Manganese as Pyrophosphate. By WILHELM BÖTTGER (*Ber.*, 1900, 33, 1019—1022).—Accurate results can be attained in the estimation of manganese as pyrophosphate by precipitating with ordinary sodium phosphate in a neutral solution to which 5—10 mol. of an ammonium salt have been added. The precipitate must be washed with cold water containing a little ammonia until no residue is left on evaporating the filtrate and igniting. A. H.

Estimation of Manganese as Sulphide. By JOHN PATTINSON and HUGH S. PATTINSON (*Chem. News*, 1900, 81, 193).—When the sul-

phide method of estimating manganese is employed, the sulphide precipitate should be examined for barium, cobalt, iron, silicon, calcium, magnesium, &c., and the filtrate should be acidified, treated with bromine to oxidise separated sulphur, then mixed with excess of ammonia and bromine, and any precipitate of manganese added to the main sulphide precipitate. D. A. L.

Electrolytic Estimation of Manganese in Manganese Ores. By ARTHUR HIORNS (*Chem. News*, 1900, 81, 15).—The solution, which should not contain more than 0.03 gram of manganese, should be made strongly acid with nitric acid, and be kept so during the operation. A tared platinum dish serves for the positive electrode, a spiral of platinum wire for the negative, and when the current is started the temperature is raised to, and maintained at, 60°. Twelve hours suffices for the deposition of all the manganese, which is washed, dried, ignited, and weighed as Mn_2O_3 . D. A. L.

Estimation of Manganese in Steel. By HORACE JERVIS (*Chem. News*, 1900, 81, 171—172).—In the method of estimating manganese by dissolving the sample in nitrosulphuric acid, oxidising with red lead, and titrating the filtrate with ferrous sulphate and permanganate, the quantity of the latter reagent consumed at first increases with the amount of manganese present, but when a maximum of 0.180 per cent. of manganese in the solution in the presence of iron, or 0.224 per cent. in the absence of iron, is attained, any further increase in the manganese causes a corresponding decrease in the consumption of permanganate. D. A. L.

Soluble Ferric Pyrophosphate. By W. E. RIDENOUR (*Chem. Centr.*, 1900, i, 834; from *Amer. J. Pharm.*, 72, 125—128).—The author has modified the orthophosphate test of the U.S. Pharmacopeia for the purity of soluble iron pyrophosphate as follows: 1 gram of the sample is boiled with 10 c.c. of aqueous potassium or sodium hydroxide to remove the iron, the filtrate is acidified with hydrochloric acid, ammonia is added in slight excess, and then magnesium mixture (10 grams of magnesium sulphate, 20 grams of ammonium chloride, dissolved to 120 c.c.) as long as a precipitate is formed; this precipitate should be soluble in a slight excess of acetic acid, and should not reappear on boiling the solution.

If the sodium pyrophosphate used in the preparation of the iron compound is free from orthophosphate, there is no fear of the latter containing any orthophosphate, no transformation occurring. L. DE K.

Analysis of Molybdenum Alloys. By HUGO BORNTRÄGER (*Zeit. anal. Chem.*, 1900, 39, 91).—About a gram of the alloy is dissolved in 50 c.c. of aqua regia, the solution evaporated to dryness, and the nitric acid expelled by hydrochloric acid. The residue is treated with 50 per cent. alcohol, when most of the molybdenum will remain undissolved as molybdic acid, but part dissolves as chloride. The solution is evaporated to dryness, and the residue again treated with 50 per cent. alcohol, when the remainder of the molybdenum is obtained as molybdic acid (compare Abstr., 1898, ii, 649). M. J. S.

Separation of Tungsten and Molybdenum. By FRED IBBOTSON and HARRY BREARLEY (*Chem. News*, 1900, 81, 13—15).—Heating mixtures of molybdic and tungstic oxide in a muffle is not adapted to the direct estimation of the molybdenum. In such mixtures, 90 per cent. of the molybdenum volatilises readily, but the remaining 10 per cent. requires prolonged and strong heating for its expulsion. The separation of these oxides by means of hydrochloric acid is imperfect, the molybdic anhydride not being absolutely soluble and the tungstic anhydride not absolutely insoluble. A procedure recommended is to precipitate the two together by means of lead acetate, wash slightly with hot, very dilute acetic acid, ignite, dissolve the residue by heating gently with concentrated hydrochloric acid, using 1 c.c. for each centigram of lead salt, then add two or three times the volume of boiling water, boil, redissolve the precipitate in hydrochloric acid, reprecipitate with water, and determine the molybdenum as lead molybdate. When the proportion of tungsten is small, the solution of the ignited lead salts is evaporated to a pasty consistency with a few drops of nitric acid, treated with 100 to 200 c.c. of dilute hydrochloric acid (3 : 1), and boiled.

D. A. L.

Test for Tin. By ALLEN ROGERS (*J. Amer. Chem. Soc.*, 1900, 22, 220—221).—The usual ammonium molybdate solution is stated to be a very delicate confirmatory test for stannous chloride, with which it produces a dark blue colour, even if the amount of stannous chloride does not exceed 0.000021 gram per c.c. Even when this solution is diluted five times, and consequently does not give any reaction with mercuric chloride, it still shows a faint blue tint with the molybdic reagent.

L. DE K.

Detection of small Quantities of Gold in Ores. By THEODOR DÖRING (*Chem. Centr.*, 1900, i, 734—735; from *Berg.-Hüttenm. Zeit.*, 59, 73—76, 97—99. Compare this vol., ii, 371).—The ore is treated with a volatile iodine compound, such as ammonium iodide containing free iodine, or preferably with a solution of bromine in ether. Into the solution is dipped, six times in succession, a strip of filter paper 10 cm. long and 2 c.c. wide; this is then burnt, when, if gold is present, it will leave an ash of a purple colour, or if the solution contained more than 0.007 per cent. of gold, the colour will be yellow or brownish-red. The reaction is interfered with by the presence of iron or platinum should these metals have passed into the solution. The filter paper is prepared by soaking ash-free filter paper into a solution of magnesium nitrate containing 0.1 per cent. of magnesium oxide, and then exposing it, when dry, to the fumes of ammonium carbonate. An alternative process is given, based on the formation of purple of Cassius, which is a modification of Ohly's method. 100 grams of the finely-powdered and roasted ore are treated in a glass-stoppered bottle with 2 c.c. of a mixture of equal volumes of bromine and ether, and the bottle is frequently shaken for two hours; during this time bromine fumes must be plainly visible. The mass is then digested for 2 hours with 50 c.c. of water, the solution is filtered and concentrated to one-fifth of its bulk, and a little bromine water and then an excess of stannous chloride added, which will then give the usual reaction. One part of gold in 2,000,000

parts of ore may be thus detected. Tellurium interferes with the test.

L. DE K.

Detection of Benzene in Denatured Alcohol. By GEORGES HALPHEN (*J. Pharm.*, 1900, [vi], 11, 373—375).—The alcohol is mixed with brine and extracted with carbon disulphide, which dissolves the benzene. The carbon disulphide extract is then treated with a mixture of Nordhausen sulphuric acid and fuming nitric acid. The acid layer which now contains the benzene as nitrobenzene, is separated, mixed with water, and extracted with ether. The ethereal extract is evaporated, and the residue reduced with zinc dust and dilute hydrochloric acid. The solution is next filtered, and a few drops of a solution of sodium nitrite added to the filtrate, which is then neutralised with sodium carbonate. An alkaline solution of α -naphthol is finally added, when, if benzene is present, an orange-red coloration will be produced.

H. R. LE S.

Hundertkräuter-Likör (Centerba). By GIULIO PARIS (*Zeit. Unters. Natur.-Genussm.*, 1900, 3, 153—158).—This liqueur, prepared in the Abruzzi, occurs mainly in two forms, the *potabile*, which is sweet, and the *semplice*, which is more strongly alcoholic and is not sweet. The author has estimated the alcohol, free acid, total solids, ash, esters, fusel oil, sucrose, and glucose in several specimens of each variety obtained direct from the factories. Of the *centerba semplice* there appear to exist two varieties, one of which is coloured green by chlorophyll, and is prepared by extracting aromatic herbs with alcohol; the other is coloured with artificial dyes. M. J. S.

Some Properties of Glycerol. By HEINRICH STRUVE (*Zeit. anal. Chem.*, 1900, 39, 95—99).—Commercial glycerol contains 6—8 per cent. of water. After drying over sulphuric acid in a partial vacuum, it still retains 1.52 per cent. of water. After drying in this manner, it gains slightly in weight if exposed in a platinum crucible in the water oven, but at the same time a small loss of glycerol takes place (compare Abstr., 1899, ii, 816). Glycerol also volatilises in small amount when its aqueous solution is distilled (see Abstr., 1895, ii, 537). Dehydrated glycerol absorbs about 17 per cent. of water on exposure to the atmosphere. Some of the author's conclusions are based on the sp. gr. of the glycerol (compare Abstr., 1899, ii, 64).

M. J. S.

[**Estimation of Pentoses in Urine.**] By SULEIMAN BEY (*Chem. Centr.*, 1900, i, 803—804; from *Zeit. klin. Med.*, 39, 305—312).—In order to determine the quantity of pentoses in urine, it is necessary to evaporate until the liquid contains 2—3 per cent., and then only 92 per cent. of the theoretical quantity is obtained by precipitating with twice the volume of alcohol. The barium dipentosates are also carried down with the barium glucosates, which have a different composition, and it is impossible to isolate the sugar in this way from a urine containing 0.75 per cent. of xylose. The phloroglucinol and orcinol reactions of the pentoses are not distinguishable in presence of large quantities of glucose, but in such cases the pentoses may be estimated by separating as the barium compounds, and fermenting.

In reference to the use of phenylhydrazine in fermentation experiments, it is to be noted that mixtures of pentosazone and glucosazone often show a higher melting point than that of glucosazone alone.

Since rhamnose does not form a barium compound which can be precipitated by alcohol, it may be readily separated from the pentoses, but it cannot be detected by the orcinol or phloroglucinol reactions in the presence of comparatively small quantities of xylose. Xylose and rhamnose may be estimated in a mixture by first determining the reducing power of both sugars, and then precipitating the xylose in another portion, and determining the reducing power of the filtrate after removing the barium and alcohol. The results obtained are, however, 1—2 per cent. too high for the rhamnose. In separating arabinose and rhamnose, the greater solubility of barium diarabinoate in alcohol prevents the complete precipitation of this compound.

E. W. W.

Analysis of Golden Syrup. By NORMAN LEONARD (*Analyst*, 1900, 25, 85—87).—The author replies to the criticism of Bodmer, Leonard, and Smith's process (this vol., ii, 320) by Miller and Potts (*ibid.*), and states that their suggested improvement is not suited so well for the wants of public analysts as the process given by himself and colleagues.

L. DE K.

Treacle or Golden Syrup. By EDWARD W. T. JONES (*Analyst*, 1900, 25, 87—89).—The author suggests the following simple formula for arriving at the percentage of glucose syrup in a sample of golden syrup if this has a *dextro*-rotation *after inversion*.

$$[a], \frac{([a], \text{after inversion} + 12.3) 100}{133.3} = \text{per cent. of glucose syrup.}$$

$$[a]_D \frac{([a]_D \text{ after inversion} + 11) 100}{120} = \text{per cent. of glucose syrup.}$$

A sample of commercial golden syrup declared to contain 18 per cent of glucose syrup had a specific rotation *after inversion* of $[a] + 12.3$ or $[a]_D + 11.07$ therefore by the above formula it shows 18.4 per cent.

The method of working is as follows. A 10 per cent. solution is made at 15.5°, and its sp. gr. taken. This should not be less than 1.032, indicating 20 per cent. of water. The factor, 3.86, is correct for about 10 per cent. solution of pure sucrose, but when dealing with ordinary golden syrups, the amount of water thus found is too low to the extent of about 3 per cent. The solution is now heated to 17.5°, and examined in the 10 cm. tube. Fifty c.c. of the same solution are heated with 5 c.c. of normal acid in a 100 c.c. flask in boiling water for 20 minutes, cooled, mixed with 5 c.c. of normal soda, and then diluted to 100 c.c. at 15.5°. This solution is again polarised at 17.5° and the result multiplied by 2.

For the cupric reducing power, if required, 10 c.c. of the first solution is taken and diluted to 100 c.c.; 20 c.c. of this is added to 50 c.c. of Fehling's solution diluted with 30 c.c. of water which has been standing for some time in boiling water. After 12 minutes, the cuprous oxide is collected, washed, and gradually ignited in a porcelain

crucible to convert it into oxide, from which the amount of sugar corresponding is calculated. Of the inverted solution, 20 c.c. are diluted to 100 c.c., and of this 20 c.c. are treated in the same manner; the difference in copper oxide represents cane sugar. L. DE K.

Analysis of a Sample of Treacle and of so-called Golden Syrup. By CHARLES G. MATTHEWS and A. HYDE PARKER (*Analyst*, 1900, 25, 89—94).—The process adopted by the authors consists in taking the sp. gr. of a 10 per cent. solution of the sample, and making a due allowance for the ash. The usual factor, 3.86, is then used for calculating the organic solid matter. Cane sugar is estimated by polarising the solution as usual after a partial fermentation with yeast at 52° for 5 hours, and boiling to destroy birotation. The cupric reducing power is taken by the gravimetric method on 0.1 gram of the sample. The rotation and cupric reducing power are also taken after fermenting for 72 hours at 18°. When analysing commercial golden syrup, a determination is also made of combined dextrin (amyloindextrin), by treating of the fermented solution with cold water malt extract, and noticing the increase in cupric reducing power, but as a further fermentation on adding yeast does not take place to any appreciable extent, the authors do not think themselves justified in using the figures so obtained for dextrin.

Using a Soleil-Ventzke-Scheibler apparatus, the value of a 1 per cent. solution of the substance observed in a 20 cm. tube has been taken to be: for maltose, 8.02 divisions; for dextrin, 11.56; for dextrose, 3.05; for gallisin, 4.85; and for cane sugar, 3.84. These figures may be converted into Laurent degrees by multiplying by 0.344.

The cupric reducing power for maltose has been taken as 1.37; for dextrose, as 2.46; and for gallisin, as 1.01. L. DE K.

The Unrestricted Use of Starch Syrup in Articles of Food. By JOSEF KÖNIG (*Zeit. Unters. Nahr.-Genussm.*, 1900, 3, 217—221).—In Germany, the employment of starch-sugar, or syrup in articles of food without declaration is prohibited, but in view of the harmlessness of these products and the advantageous results which they afford in certain confections, the question has been raised whether this restriction is called for. The presence of dextrin in these articles, and especially in the syrup, confers on them a viscosity which enables them to take the place of stronger solutions of cane sugar, and in consequence of the hindrance which the presence of 5—10 parts of starch syrup in 100 parts of cane sugar opposes to the crystallisation of the latter, enables them in part to replace fruit juice itself. The author has made comparative estimations of the viscosity of solutions of cane sugar, starch sugar, and starch syrup, both with Engler's viscosimeter and with Weiss' "consistence measurer," and gives the preference to the latter, both from its convenience in use, and from the fact that when the retardation of the revolutions is calculated for a unit weight of substance, the results are almost independent of the concentration of the solution, which is by no means the case with the viscosimeter.

M. J. S.

Estimation of Cellulose. By CARL BECK (*Zeit. Unters. Nahr.-Genussm.*, 1900, 3, 158—164).—Upwards of 45 methods of estimating

cellulose in vegetable structures have been proposed. That of Henneberg and Strohmänn, which for 30 years has been generally accepted, consists in boiling the substance with dilute sulphuric acid (1.25 per cent.) and then with potassium hydroxide of corresponding strength. Lebbin (*Arch. Hyg.*, 1897, 212) suggested the use of a mixture of hydrogen peroxide and ammonia, and König (*Abstr.*, 1899, ii, 68) has proposed heating under certain defined conditions with a mixture of glycerol and sulphuric acid, the special object being the removal of pentosans. The author has made comparative estimations in cotton-wool, filter-paper, straw, wood-wool, wheat-bran, pearl barley, and wheat flour, by the three methods, as well as by a modification of Lebbin's method (which is not described because the author himself does not recommend it), and concludes that Lebbin's process has neither a scientific nor a practical value; that in König's method (with a reflux apparatus) it is difficult to maintain the exact temperature prescribed, and that the results obtained with a small gas flame are higher than those with a large flame. Finally, that Henneberg's process gives the most concordant results, and is, on the whole, the most trustworthy. König's reagent attacks cellulose itself strongly; nevertheless, his process gives higher numbers than Henneberg's with bran and flour.

M. J. S.

[Estimation of Cellulose.] By JOSEF KÖNIG (*Zeit. Unters. Nahr. Genussm.*, 1900, 3, 164—166).—The discordant results obtained by Beck with the author's process are due to the irregularity of the temperature of boiling. If the instructions are carefully complied with and a small flame is used, the temperature will only vary between 131° and 133°, and should never be allowed to exceed the latter.

M. J. S.

Isolation and Separation of the Chief Organic Acids. By N. SCHOORL (*Zeit. angew. Chem.*, 1900, 367—370).—The process is based on the fact that formic and acetic acids may be distilled in a current of steam after acidifying the liquid to be tested with sulphuric acid, congo test-paper serving as indicator.

The residue, after being concentrated on the water-bath, is extracted in a suitable apparatus with ether, which rapidly dissolves salicylic, benzoic, succinic, and lactic acids, and gradually removes oxalic, malic, citric, and even tartaric acids.

The ether is then evaporated and the residue treated with boiling water, which, on cooling, deposits most of the salicylic and benzoic acids. The further separations present, on the whole, no novel features. The microscope renders good service in the recognition of calcium citrate or zinc lactate.

L. DE K.

Estimation of Formic Acid in Presence of Acetic Acid. By FIN SPARRE (*Zeit. anal. Chem.*, 1900, 39, 105—106).—The author recalls and strongly advocates the method of Portes and Ruyssen (*Abstr.*, 1876, ii, 663), but points out that the instruction to employ a 10 per cent. solution of the substance must be a misprint for 1 per cent., since the quantity of mercuric chloride prescribed is not sufficient for the stronger solution, and with solutions containing more than 1 per cent. of formic acid the results are too high.

M. J. S.

Cider Vinegar: Its Solids and Ash. By R. E. DOOLITTLE and WILLIAM H. HESS (*J. Amer. Chem. Soc.*, 1900, 22, 218—220).—Pure cider vinegar may be distinguished from spurious vinegar (generally made from dilute acetic acid) by the fact that the solids consist of glycerol, albuminous matters, gums, malic and other organic acids and mineral matters, give no rotation in the polariscope and have little or no cupric reducing power after the usual clarification with lead acetate. On the other hand, the spurious vinegars leave generally a residue of molasses-like appearance and properties.

The ash of cider vinegar, which should amount to not less than 0.25 per cent., contains principally potassium, with small amounts of aluminium, calcium, magnesium, and sulphuric and phosphoric acids, with variable amounts of carbon dioxide, but its chief characteristic is the complete absence of sodium. Spurious substitutes often contain a large proportion of either calcium or sodium.

Analyses are given of the solids and the ashes of cider, cider vinegar, and spurious samples. L. DE K.

Estimation of Uric Acid in Urine. By ADOLF JOLLES (*Zeit. physiol. Chem.*, 1900, 29, 222—248).—By boiling with an excess of permanganate in a solution acidified with sulphuric acid, uric acid is quantitatively converted into urea, which can then be estimated by the hypobromite process. The urine (50—200 c.c. according to concentration), which, if necessary, must be warmed to dissolve urates and be filtered if turbid, is treated with solid ammonium acetate (1 gram per 10 c.c.) and made feebly alkaline with ammonia. After $2\frac{1}{2}$ —3 hours, the ammonium urate is collected on a filter, and washed free from chlorides with a saturated solution of ammonium carbonate. It is then rinsed into a beaker and boiled with 0.1—0.2 gram of pure magnesia for $\frac{1}{2}$ — $\frac{3}{4}$ hour, or until perfectly free from ammonia. The liquid, measuring 300—400 c.c., is then acidified with 10 c.c. of sulphuric acid (sp. gr. 1.4) and permanganate solution (8 grams per litre) is gradually added, until the last c.c. remains unreduced after 15 minutes boiling. The excess of permanganate is removed by oxalic acid, the liquid cooled, rendered alkaline with soda, and transferred to the reaction vessel (330 c.c. capacity) of a special azotometer, where it is treated with hypobromite. Test estimations, with pure uric acid, gave excellent results. When applied to urine, the results were compared with those of the Ludwig-Salkowski process (*Wien. med. Jahrbuch*, 1884, 97), which the author affirms to be trustworthy and exact, but which is admitted by Ludwig to give numbers which are 2 per cent. too low. With a number of normal and pathological urines, the differences ranged from -1.9 to +5.0 per cent., the average difference being 2 per cent. above the Ludwig-Salkowski numbers. The present method may, therefore, be regarded as one of the most exact. The Hopkins-Folin method (*Abstr.*, 1898, ii, 196), which gives accurate results with pure uric acid, is liable to give excessively high numbers with certain pathological, and especially with highly concentrated, urines. M. J. S.

Estimation of Fat in Dairy Produce. By LÉON LINDER (*J. Pharm.*, 1900, [vi], 11, 368—373. Compare this vol., i, 67).—This

method is based on the fact that a hot solution of resorcinol dissolves the casein from milk, cheese, &c., and leaves the fat as a supernatant layer, which is easily distinguished from the lower layer if the milk has been previously coloured with a little magenta. If the milk is rendered faintly alkaline with sodium hydroxide, the casein is readily dissolved by simply heating the mixture in boiling water. Five grams of resorcinol, 5 c.c. of the milk, 2 drops of a solution (36°) of sodium hydroxide, and 1 drop of the colouring solution are heated in a special form of graduated tube, and the volume of the separated fat is read off. One gram of butter fat at 15° occupies 1.154 c.c. In the case of cheese, 1 gram of the substance and 15 c.c. of a hot, aqueous 100 per cent. solution of resorcinol are the quantities employed. The method is rapid, and gives accurate results. H. R. LE S.

Sour Milk. By H. DROOP RICHMOND and J. BRISTOWE P. HARRISON (*Analyst*, 1900, 25, 116—124).—The first part of the paper is devoted to an investigation of the fact noticed by de Koningh (Abstr., 1899, ii, 707) that milk, on being mixed with 5 per cent. of a solution of sodium hydroxide of the same sp. gr., suffers a diminution in sp. gr. The authors confirm this fact, but state that it depends on the state of acidity of the milk, because when lactic (or, in fact, any other) acid is neutralised with solution of soda, the resulting sp. gr. is less than the calculated sp. gr. If, however, ammonia is used for neutralisation, the resulting sp. gr. is practically the same as the calculated one. Tables are given showing the loss in sp. gr. when various acids are neutralised with soda, and of the slight increase noticed when ammonia is used.

Owing to this fact, the authors think that ammonia is the best alkali for the purpose of liquefying sour milk so as to be able to take its sp. gr. with a hydrometer. This idea is not novel, having already been proposed in 1893 by Weibull, but the authors have much simplified the process by mixing pure milk with 5 per cent. by volume of a strong ammonia, and noticing once for all the decrease in sp. gr. which takes place. Sour milk is then treated in the same manner, and the loss caused by the ammonia is allowed for. If the operator prefers using de Koningh's process (*ibid.*), the loss in sp. gr. will be 0.02 for every degree of lactic acid. It must be borne in mind that the acidity of milk is not entirely due to lactic acid; in fact, fresh milk, which is fairly neutral to litmus paper, still shows an acidity of about 20° manifested towards phenolphthalein.

The second part of the paper is devoted to the point at which milk may be considered to be sour, and the rate of souring in the presence or absence of preservatives. The figures as to the degree of acidity necessary to cause the coagulation of milk on boiling confirm the previous experiments of Stokes, who stated that milk is sour when the acidity reaches 44° .

Tables are given showing the retardating action of formaldehyde and boric preservative on the formation of the additional acidity.

L. DE K.

Foreign Colouring Matter in Milk. By ALBERT E. LEACH (*J. Amer. Chem. Soc.*, 1900, 22, 207—210).—150 c.c. of the sample

are heated in a casserole and curdled by means of acetic acid. The curd is, if possible, gathered in one mass, and the whey poured off; or, if the curd is finely divided, the mass is strained. The pressed curd is macerated in a corked flask with ether, which is then poured off and evaporated. The residual fat is treated with aqueous sodium hydroxide, which is then passed through a wetted filter; the fat is washed off the filter and the latter is dried, when, should it have an orange colour, the presence of annato is indicated, which may be further confirmed by the pink colour produced in contact with stannous chloride.

If the extracted curd is colourless, it has no other foreign colour, but if orange or brownish, it may contain aniline-orange, or caramel. It is then shaken in a test tube with strong hydrochloric acid; should it immediately turn pink, aniline-orange is present, but if it turns gradually blue, it indicates caramel, which may be confirmed by the usual tests applied to the whey. L. DE K.

Butters from Various Countries Compared. By CHARLES ESTCOURT (*Analyst*, 1900, 25, 113—116).—This is a tabulated record of the analysis of some 250 samples of butter imported from Finland, Denmark, Iceland, Sweden, Canada, and Germany. The testing was restricted to the percentage of water, the Reichert figure, and search for preservatives.

The results given by the Reichert process varied from 11.9 to 16 c.c. of decinormal alkali. The preservative found in a few foreign samples consisted of boric acid to the extent of about 8—9 grains per pound, but of the 39 samples of Irish butter 35 contained boric acid to the extent of 5—46 grains per pound. The highest percentage of water met with was 20 per cent.; the lowest 8 per cent. L. DE K.

Detection of "Process" or "Renovated" Butter. By WILLIAM H. HESS and R. E. DOOLITTLE (*J. Amer. Chem. Soc.*, 1900, 22, 150—152).—"Process" or "renovated" butter is an article prepared by melting rancid butter and mixing the clarified fat with milk. The method given for the identification of such butter is based on the fact that the curd from cream such as exists in genuine samples of butter is physically and chemically different from curd derived from milk.

When the curd of a sample of "process" butter is separated by washing with ether, and then spread out in a thin layer on a clean glass plate, its physical appearance when viewed with a magnifier of 3—6 diameters is quite distinct from that obtained from genuine butter. The latter has an amorphous, non-granular appearance, whilst the curd of the former has a very coarse, curdy appearance. The curd from cream is a gelatinous, ropy mass, which settles rapidly, but the other is a granular, easily divided substance. Casein dissolves readily in acid or alkali; the curd of genuine butter only dissolves on prolonged treatment with these reagents. The curd of pure butter yields scarcely any albumin to water, but when the curd from milk, after thorough washing with ether, is treated with water, the filtrate coagulates on adding acetic acid and boiling. By means of the Kjeldahl process, the relation between casein and albumin may be

readily estimated, and in samples containing only the curd of milk this amounts to 9 : 1.

L. DE K.

Comparison of some Tests for Formaldehyde. By BENJAMIN M. PILHASY (*J. Amer. Chem. Soc.*, 1900, 22, 132—135).—Schiff's reagent, magenta decolorised by sulphurous acid, is not a trustworthy test, as the violet coloration is also obtained by the action of the air or by warming the suspected liquid. The scarlet ring noticed when liquids containing formaldehyde are poured on to sulphuric acid containing a little phenol is also produced by most other aldehydes. The same may be said of the violet colour produced by diazobenzene-sulphonic acid in the presence of free alkali and sodium amalgam. Nessler's solution, and also aniline, give a precipitate both with formaldehyde and acetaldehyde.

The author has proved that Trillat's dimethylaniline test does not show the presence of formaldehyde, but is due to the dimethylaniline itself, or of its salts when these are not completely volatilised.

Lebbin's test is supposed to detect 1 part of formaldehyde in 10,000,000 parts of water, but the author states that 1 in 200,000 is the limit. The purple ring formed by bringing the liquid in contact with a solution of morphine hydrochloride in sulphuric acid is no longer distinct if the dilution of the formaldehyde exceeds 1 : 1000.

A solution of 1 gram of phenylhydrazine hydrochloride and 1.5 grams of sodium acetate in 10 c.c. of water seems to be the best reagent. To 1 c.c. of the liquid 2 drops of the reagent and 2 drops of sulphuric acid are added, producing a green coloration. When the dilution is 1 : 10,000 or 1 : 100,000, 3 c.c. of the liquid, 4 drops of the reagent, and 4 drops of sulphuric acid are used, and the mixture is heated for half a minute. In case of a dilution 1 : 250,000, 3 c.c. of the liquid are heated for about a minute with 5 drops of the reagent and 5 drops of sulphuric acid, when a very light tinge of green will be noticed after 3 minutes, and a decided tint after 10 minutes.

Another delicate test has been proposed by Rimini: 1 c.c. of the liquid is mixed with 2 drops of solution of phenylhydrazine hydrochloride, 2 drops of solution of sodium nitroprusside, and 1 c.c. of aqueous sodium hydroxide. A blue colour is developed, which changes quickly to green, yellow, light brown, and red; a peculiarity is the rise of the red colour to the top, leaving a yellow layer below. The limit for this test seems to be reached when the dilution is as 1 : 1,000,000.

L. DE K.

Two Deceptive Reactions. By CARL AMTHOR (*Zeit. Unters. Nahr.-Genussm.*, 1900, 3, 233—235).—The violet colour observed by Leonard and Smith (*Abstr.*, 1899, ii, 454) when milk containing formaldehyde is heated with fuming hydrochloric acid, and by Fisher with milk to which boric acid has been added, is obtainable with normal milk, and is a reaction of albuminous substances in presence of sugar. With sour milk from which most of the sugar has disappeared, or with muscular tissue or egg-albumin, the reaction is feeble, but in all these cases it is given strongly after adding lactose. The

colour may also be obtained with butter if new and used in the unfiltered state, in consequence of the presence of both casein and lactose. With old butter, the reaction is only observed after adding some lactose. It is producible in the cold, but more strongly on heating, and appears to be due to the formation of furfuraldehyde by the action of the acid on the sugar present. It is, in fact, immediately obtained with unfiltered butter to which some furfuraldehyde is added. The furfuraldehyde test for sesamé oil is therefore quite untrustworthy if applied to butter which has not, by filtration or by dissolving in ether, been completely freed from proteids (compare this vol., ii, 325). M. J. S.

Colour Reaction of Acetaldehyde. II. By ENRICO RIMINI (*Gazzetta*, 1900, 30, i, 279—281).—The colour reactions obtained by Lewin (this vol., ii, 179) by the addition of a secondary amine and sodium nitroprusside to either acetaldehyde or propionaldehyde were described in earlier papers by the author (this vol., ii, 56, and *Rendiconti Amministr. Civile. Ministero del Interno*, 1898). As stated by Simon (*Abstr.*, 1898, ii, 315), no reaction is obtained with carefully purified paraldehyde. T. H. P.

Physico-chemical Properties of Chloral Hydrate and their Applications to Pharmacology. By RICHARD MAUCH (*Zeit. anal. Chem.*, 1900, 39, 116—131; from *Diss. Strassburg*, 1898).—The author greatly extends Schaefer's observations (this vol., ii, 57) on the solvent powers of strong (60—80 per cent.) solutions of chloral hydrate and chloral alcoholate. With few exceptions, the reactions of the alkaloids can be well observed with their chloral hydrate solutions. Most resins and gum resins, camphors, tannins, organic dyes, sugars, dextrans, gelatin, and keratin are also freely soluble. The dammar resins from dipterocarpous trees are almost insoluble, whilst those from *Coniferae* dissolve completely. Many reactions of solutions of gum-resins and balsams are described in the paper. M. J. S.

Vanillin in Wine Vinegar. By A. STOCKT (*Zeit. Unters. Nahr.-Genussm.*, 1900, 3, 235).—In two samples of commercial vinegar, a substance was detected having the odour of vanillin. The acid was evaporated with calcium carbonate, the residue extracted with ether, and the residue from the evaporation of the ethereal extract crystallised from alcohol. It reduced ammoniacal silver solution, and gave Etti's phloroglucinolvanillin (Abstr., 1883, 62). M. J. S.

[**Estimation of Carvone in Essential Oils.**] By HENRI LABBÉ (*Bull. Soc. Chim.*, 1900, [iii], 23, 280—286).—See this vol., i, 398.

A Quantitative Reaction of Ureides and Purine Derivatives. By ADOLF JOLLES (*Ber.*, 1900, 33, 1246—1248).—A number of ureides and purine derivatives are not oxidised directly to ammonia by potassium permanganate and sulphuric acid, but give a quantitative yield of carbamide, provided that the weight of acid does not exceed 40 grams per litre. After removing the excess of permanganate with oxalic acid, neutralising with alcoholic potash, and evaporating nearly to dryness, the carbamide can be extracted from the inorganic salts with

absolute alcohol, precipitated with ethereal oxalic acid, and the oxalate analysed in the usual way.

The nitrogen is completely converted into carbamide in the case of alloxan, alloxantin, allantoin, uric acid, and xanthine. In hypoxanthine, adenine, and guanine, 1 atom of nitrogen appears in the form of guanine, and the remaining 4 atoms as urea. T. M. L.

[Estimation of Nicotine in Cigars.] By HERMANN THOMS (*Chem. Centr.*, 1900, i, 826—827; from *Ber. Deut. pharm. Ges.*, 10, 19—31).—See this vol., ii, 428.

Strychnine Salts and Chloroform. By J. RUTHERFORD HILL (*Pharm. J.*, 1900, [iv], 10, 185).—Normal salts of strychnine are not quite insoluble in chloroform. One part of the hydrochloride dissolves in 169 parts of chloroform, the arsenate requires 1178 parts, and the sulphate 1055 parts; but in the case of the arsenate and sulphate the portion dissolved is no longer the pure normal salt, but contains free alkaloid.

When aqueous solutions of these salts are shaken with chloroform, the latter abstracts a small amount of the hydrochloride as such, particularly in the presence of hydrochloric acid, but with the two other salts a notable amount of alkaloid is abstracted, leaving the liquid correspondingly acid. The only way to prevent even traces of strychnine from passing into the chloroform is to add a fair excess of sulphuric acid. L. DE K.

Action of Chloroform and Similar Solvents on Alkaloid Salts. By EDWARD SCHAEER (*Pharm. J.*, 1900, [iv], 10, 308).—The author is continuing Hill's researches (preceding abstract).

Experiments already made with atropine and veratrine have shown that their acid salts are also soluble in ether or chloroform. 0.102 gram of atropine dissolved in water acidified with tartaric acid yielded 0.0623 gram to 30 c.c. of chloroform and 0.0913 to the same quantity of ether. Veratrine dissolved in solution of tartaric acid yielded to chloroform an amount of veratrine tartrate varying with the quantity of free acid present. L. DE K.

Examination of Tea. By ADOLF BEYTHIEN, PAUL BOHRISCH, and JOSEPH DEITER (*Zeit. Unters. Nahr.-Genussm.*, 1900, 3, 145—153).—An attempt to estimate the extractive matter in tea by Trillich's method, which consists in taking the specific gravity of an extract obtained by boiling 10 grams of tea with 250 grams of water for 15 minutes, gave results about 10 per cent. below those yielded by complete exhaustion. In consequence of the bulkiness of boiled tea-leaves and the slowness with which they yield up their extractive matter, 5 grams of tea requires four boilings with 750 c.c. of water each time to extract it completely. The extract should not be evaporated, but the exhausted leaves be dried and weighed, allowance being made for the moisture in the original substance. Identical results are obtained by a percolation method, in which the tea, supported in a tube on cotton-wool, is exposed for 8—10 hours to the percolation of condensed steam from the receiving flask, but when numerous samples have to be examined the following method gives good results with very little

trouble : 3 grams of the tea are placed on a circular piece of linen, which is then drawn together, so as to form a small bag ; 8 to 10 of these bags, each weighted with a numbered piece of lead, are suspended in an enamelled saucepan full of water, which is kept boiling, and is changed for fresh water either intermittently or continuously. When the decoction is no longer coloured, the bags are spread open, dried, and the exhausted tea-leaves transferred to watch-glasses. The extraction by this method requires 3 or 4 days.

The examination of 130 samples of tea, purchased in Dresden, showed, in 100 parts :

	Extractive matters.	Ash.	Ash soluble in water.	Percentage of ash soluble in water.
Mean	35.03	5.78	3.13	54
Minimum ...	29.53	5.32	2.08	33
Maximum ...	44.75	6.40	3.99	68

All the samples appeared to be perfectly genuine.

M. J. S.

Testing Antipyrin for Antifebrin, Phenacetin, and Exalgin. By P. N. RAIKOW and P. SCHTARBANOW (*Chem. Centr.*, 1900, i, 999 ; from *Oesterr. Chem. Zeit.*, 3, 125—127).—By-boiling with phosphoric acid of sp. gr. 1.7, in which these substances are soluble, the anilides antifebrin and phenacetin are hydrolysed and yield acetic acid free from bye-products, so that very small quantities may be recognised. Antipyrin colours the phosphoric acid golden-yellow, which gradually becomes darker and brownish-yellow. Antifebrin gives a pale yellow colour, turning brown on prolonged boiling. Phenacetin causes first a rose, then a brownish-red coloration, passing from reddish-violet, through violet and bluish-green into dirty green. The appearance of the violet colour is particularly characteristic for phenacetin.

Antifebrin and phenacetin are distinguished by their behaviour towards potassium hydroxide. A few grams of the substances are heated with 2—4 c.c. of strong aqueous potash in a test-tube closed by a perforated india-rubber cork, through which passes a bent tube dipping into another test-tube containing 1 to 3 c.c. of a clear solution of bleaching powder. In the presence of antifebrin, the first drops which distil over cause the well known violet colour due to aniline. In the absence of antifebrin and the presence of phenacetin, the first drops cause no colour, but those following give a vermilion-red turbidity, due to phenetidine ; finally, an amorphous, red substance separates on the surface of the liquid, which becomes clear yellow after some time. If the test-tube is changed, both the reactions, the violet colour and the separation of phenetidin may be noticed in succession. When boiling a mixture of phenacetin and antipyrin with potassium hydroxide, the distillate does not give with bleaching powder the characteristic red coloration for phenacetin, but the solution turns first yellowish-green and then yellowish-grey, whilst with antipyrin alone it remains colourless.

Exalgin readily evolves acetic acid when boiled with phosphoric acid, and the liquid turns golden-yellow. The separated methylaniline distils in oily drops, which collect on the surface of the bleaching

powder solution, and soon become green, then greyish-green, and finally dirty brown. Contrary to Fischer's statement, exalgin is easily hydrolysable by caustic alkalis.

When boiled with aqueous potash, quinine gives no volatile products which act on bleaching powder solution. When boiled with phosphoric acid, the liquid turns first yellow, and shows an intense yellow, bluish-green fluorescence; it then soon becomes dirty brown and opaque. The presence of anilides in quinine may be safely detected by this method.

Traces of *p*-aminophenol may be detected in phenacetin, antifebrin, &c., by the intense red colour developed when dissolving these substances in cold phosphoric acid. When pure, they dissolve to a colourless liquid.

L. DE K.

Analysis of Tanning Materials. By PAESSLER (*Zeit. angew. Chem.*, 1900, 318—323).—Attention is called to the fact that, in order to get trustworthy commercial results, directions issued by the "International Committee of Leather Trades Chemists" must be scrupulously followed. The merest deviation from those instructions may cause a difference of several per cent. in the amount of tannic acid found.

L. DE K.

Distinction of Indigo from other Blue Dyes on Fabrics. By FREDERIK H. VAN LENT (*Zeit. anal. Chem.*, 1900, 39, 92—95).—Indigo is readily soluble in hot phenol, and woollen fabrics dyed with indigo alone can be deprived of the dye completely by heating with that solvent in the water-bath. At higher temperatures, the fabrics are attacked. Other blue dyes except indophenol are wholly or partially unattacked, the wool remaining coloured. From cotton, indoin is dissolved as well as indigo.

M. J. S.

Rosin's Method for the Determination of the Reducing Power of Urine, &c. By SPIEGEL and PERITZ (*Chem. Centr.*, 1900, i, 675; from *Münch. Med. Wochschr.*, 47, 225—226).—The authors have arrived at the conclusion that Rosin's method with leucomethylene-blue (this vol., ii, 319) is quite untrustworthy as it is influenced by the temperature, and by other constituents of urine such as uric acid, whilst, moreover, the reducing power of the various reducing substances is not a quantitative one.

L. DE K.

[Cystine in Impure Well Waters in the Neighbourhood of Lyons.] By HENRI CAUSSE (*Compt. rend.*, 1900, 130, 579—581).—Impure well waters which had caused typhoid were found to contain cystine, probably in the form of ferric cystinate. The waters gave a yellow coloration with sodium *p*-diazobenzenesulphonate mercurichloride, weakened, but not discharged, by addition of sulphurous acid; when boiled for some time, they gave off hydrogen sulphide, free sulphur being precipitated at the same time. The cystine was isolated by precipitation with a solution of barium hydroxide containing some barium chloride, and its identity was established by recognition of its crystalline form, by determinations of the ratios C:N and Fe:S, and by its reactions with lead, silver, and mercuric salts.

The typhoid bacillus could not be isolated from the waters in

question, but they contained an abnormally large number of bacteria that liquefy gelatin, and especially of *Bacterium termo*. C. H. B.

Detection and Estimation of Cystine, and its Variation in Amount in Contaminated Water. By HENRI CAUSSE (*Compt. rend.*, 1900, 130, 785—788. Compare preceding abstract).—The reagent employed in testing for cystine in natural water is prepared by adding mercuric chloride to a solution of sodium sulphanilate, and dissolving the mercurichloride thus produced in a solution of sodium chloride. The water under examination is shaken with a few c.c. of this reagent, a few drops of dilute hydrochloric acid and potassium nitrite solution are added, and the mixture left for 6 hours in a dark place. The yellow coloration which develops in water free from cystine is entirely destroyed by sulphurous acid. The orange colour of the meniscus persists when traces of cystine are present, and in the presence of larger quantities of this substance the whole of the liquid retains its colour, and the meniscus is red.

The colorimetric estimation of cystine in water is effected by comparing the tint which persists after the addition of sulphurous acid with that obtained in a similar manner with standard solutions of cystine.

Analyses of the potable water of Lyons show that there is an intimate connection between the accumulation of cystine in the water and the outbreak of typhoid fever.

The amount of cystine in well water varies with the seasons; it is at its minimum in February and March, and reaches its maximum at the close of the summer; this is also true of the water from the Rhone; under ordinary circumstances, water from the latter source contains far less cystine than well water, but when the river is in flood, the amount of this substance greatly increases. G. T. M.

Presence of Tyrosine in Contaminated Well Waters. By HENRI CAUSSE (*Compt. rend.*, 1900, 130, 1196—1198. Compare preceding abstracts).—Tyrosine is present in contaminated well waters, which give a yellow coloration on the addition of the reagent composed of mercuric chloride and sodium *p*-diazobenzenesulphonate. The tyrosine is not originally present in the water, but results from the subsequent oxidation of the inorganic and organic constituents in the water. It was isolated either by precipitation with Millon's reagent (slightly modified) or with barium hydroxide solution.

H. R. LE S.

The Ferricyanide Method of Determining the Oxygen Capacity of Blood. By JOHN S. HALDANE (*J. Physiol.*, 1900, 25, 295—302).—When the fallacies due to incomplete laking of the blood and to the presence of bacteria are eliminated, the ferricyanide method of determining the oxygen capacity of the hæmoglobin in blood gives exact results. The present paper deals with the precautions to be taken to attain these objects; the most important modification introduced is the substitution of ammonia for sodium carbonate to prevent the evolution of carbon dioxide, the advantage being that laking is more readily produced.

W. D. H.

Simultaneous Estimation of Two Colouring Matters in Blood by the Spectrophotometer. By GUSTAV HÜFNER (*Chem. Centr.*, 1900, i, 512—513; from *Arch. anat. Phys.*, 1900, 39).—The ratios of the luminosity of different regions of the absorption spectrum of alkaline solutions of the blood-colouring matters are constant, even in the blood of different animals. Thus, with oxyhæmoglobin, the ratio of ϵ_0 , the extinction coefficient of the darkest part of the broader absorption band, 531·5 to 542·5 $\mu\mu$, to ϵ_1 ; that of the bright portion, 554—565 $\mu\mu$, between the two bands, is 1·578. Similarly, with reduced hæmoglobin, the value ϵ'_r/ϵ_r , in which ϵ'_r and ϵ_r are the extinction coefficients respectively of the same regions = 0·762. In mixtures of both oxyhæmoglobin and hæmoglobin, the equation $157·8 - (100 \cdot \epsilon'_r / \epsilon_r) / (0·529 \cdot \epsilon'_r / \epsilon_r) + 0·414 = x$, the percentage of hæmoglobin; $100 - x$ is the percentage of oxyhæmoglobin. To ascertain the absolute amount of the two colouring matters, the mixture is shaken with air, and the amount of oxyhæmoglobin estimated. For a mixture of methæmoglobin and oxyhæmoglobin, the fraction becomes $x = 157·8 - (100 \cdot \epsilon'_r / \epsilon_r) / 0·393$, in which x is the percentage of methæmoglobin, and for one of carboxy-hæmoglobin (x) and oxyhæmoglobin, $\epsilon'_r / \epsilon_r = 157·8 + 0·061 \cdot x / 100 + 0·497 \cdot x$. The original paper contains tables for these values. M. J. S.

Estimation of Absorbable Proteids in Foods. By KARL BÜLOW (*Chem. Centr.*, 1900, i, 831—832; from *J. Landw.*, 48, 1—38).—The greatest amount of proteids which can possibly be attacked are dissolved by treating foods or fæces by pepsin according to Kühn's method; some of the undissolved nitrogen is still soluble in alkaline trypsin solution. Excessive drying renders a portion of the proteids insoluble, and the temperature employed should not exceed 55—60°.

The Stutzer-Pfeiffer method for estimating digestible proteids does not yield results in accordance with those of experiments with animals. Treatment of foods with pepsin-trypsin gives numbers which are too high, whilst the action of as little as 250 c.c. of pepsin solution on fæces does not dissolve all the nitrogen soluble in acid pancreatic juice.

Kühn's method is suitable for estimating proteids dissolved by the intestines, and is useful for rapidly ascertaining the amount of digestible proteids in foods; it does not, however, render direct experiments unnecessary. The correctness of the method is established as regards ruminants; further experiments are necessary to show whether it is available in the case of other animals.

N. H. J. M.

Sulphosalicylic Acid as a Test for Albumin [in Urine]. By MANKIEWICZ (*Chem. Centr.*, 1900, i, 630; from *Berl. Klin. Woch.*, 36, Litteraturauszüge, 93).—The urine, if turbid, is clarified by means of a little magnesium sulphate or sodium hydrogen carbonate; 10 c.c. of the clear filtrate are mixed in a test-tube with 0·1—0·15 gram of sulphosalicylic acid, and well shaken. In the presence of 0·001 per cent. of albumin, a faint bluish diffused coloration is noticed on placing the tube against a dark surface; if 0·005—0·01 per cent. is present, the turbidity is plainly opalescent, and when 0·02 per cent. is present, the liquid becomes quite opaque. L. DE K.

Examination and Valuation of Commercial Pastry. By ADOLF JUCKENACK (*Zeit. Nahr. Genussmitt.*, 1900, 3, 1—17).—Artificial yellow dyes are added to commercial pastry to simulate the appearance of the use of eggs; they are, however, all soluble in 70 per cent. alcohol, but insoluble in ether, whilst lutein is soluble in both menstrua. Since yolk of egg is a residual product of certain industries, it is often used instead of entire eggs. The large proportion of cholesterol in yolk of egg renders its detection in pastry an almost certain proof of the presence of egg-substance. About 15 grams of the substance should be extracted with cold ether, the ether evaporated, the residue saponified with potash, the soap dissolved in 5 c.c. of water, and the solution shaken with ether. The crude cholesterol so obtained is extracted with chloroform; half of the chloroform solution is evaporated, and the residue crystallised from alcohol for microscopic examination; other portions are tested by Salkowski's and Liebermann's reactions.

For quantitative purposes, the phosphorus present in the form of lecithin and its compounds is estimated, since the proportion in egg so largely exceeds that in wheat flour. About 35 grams of the thoroughly dry substance is extracted with absolute alcohol in a Soxhlet apparatus at 55—60° for 10—12 hours. The matter soluble in alcohol is saponified with potash, and evaporated and incinerated in a platinum capsule. The phosphoric acid in the ash is estimated in the usual way by molybdate. By means of the equation $0.0225 \times 5 \times 86.95 + 13.16a = x(5 \times 86.95 + 12.375a)$, in which x is the amount of phosphoric acid found, there can then be calculated the number of eggs (a) which have been added to 1 lb. (500 grams) of flour, whilst if the yolks alone have been used, the equation becomes $0.0225 \times 5 \times 86.95 + 13.16a_1 = x(5 \times 86.95 + 7.835a_1)$.

To decide whether entire eggs or the yolks only have been used, a more complete analysis, including at least moisture, ash, total phosphoric acid, and nitrogen, must be made. Except in cases where yolk of eggs preserved by adding common salt has been employed, the ash will generally be in larger proportion to the total dry substance where whole eggs have been used than where only the yolks are present; whilst in the latter case phosphoric acid will form a far larger proportion of the total ash than in the former. It is to be observed that, unless an alkali is added, a loss of phosphoric acid will occur when incinerating yolk of egg; with whole eggs, this loss does not take place. For equal percentages of lecithin-phosphoric acid, the nitrogen will be higher when whole eggs are added than when the yolks only have been employed.

M. J. S.

Examination of Commercial Pastry. By SIGISMUND BEIN (*Zeit. Unters. Nahr.-Genussm.*, 1900, 3, 167—168); and by ADOLF JUCKENACK, *ibid.*, 168).—A question of priority.

M. J. S.

General and Physical Chemistry.

Refraction of Normal Salt Solutions. By CARL BENDER (*Ann. Physik.*, 1900, 2, 186—196. Compare Abstr., 1899, ii, 621).—The previous investigations are extended to solutions of potassium chloride at concentrations $N/2$, N , and $2N$, and at temperatures ranging from 10° to 70° , interpolation formulæ being given for each solution for the ranges 10° to 40° and 40° to 70° . With a fair degree of accuracy, that is, ± 2 in the fourth place of decimals, one formula only serves for the three solutions and for pure water for the range 10° to 40° , and one for 40° to 70° , the first term alone differing for the different compounds and for different wave-lengths of light, that is, the dispersion is approximately independent of temperature or concentration, and another formula is given also of the form $A + B\mu + C\mu^2$, where μ is the concentration. The molecular refraction is also calculated by both Gladstone's and Lorenz's formulæ, and the atomic refraction of the potassium is hence obtained, the values 8.5—9.6 (Gladstone) and 5.55—5.78 (Lorenz) being found. L. M. J.

Refractive Power of Methyl Acetate near the Critical Point. By PRINCE BORIS B. GALITZIN and J. WILIP (*Chem. Centr.*, 1900, i, 901; from *Bull. Acad. St. Pétersb.*, [v], 11, 117—196).—In order to determine whether the refractive power of a substance at a temperature near the critical point is the same in the gaseous as in the liquid state, direct measurements of the refractive index were made by the lens and by the prism method. In the first method, the tube containing the liquid served as a cylindrical lens, and in the second a very acute angled prism was inserted in the tube so that one face was parallel to the wall. By the former method, which proved the better, the critical temperature of ethyl acetate was found to be 193.7 — 193.8° . For accurate determinations, a good thermostat is required, and it is necessary to stir the contents of the tube in order to insure thorough mixing of the layers, for even at a temperature above the critical, the density may vary in different parts of the tube, although the temperature and pressure are the same throughout. In one case, it was found that the variations of density amounted to 35 per cent. at the critical point, and to 14 per cent. at 5° above this point. These variations probably indicate that, owing to retardation of ebullition, the substance may exist as a liquid, even above the critical point. When the liquid is thoroughly agitated, the refractive index for the same phase is the same at all parts, and is independent of the total volume occupied by the substance, if the substance is in presence of saturated vapour. If the tube is filled with a homogeneous substance, the refractive index depends only on the total volume, and is independent of the temperature. The relation between the refractive index and the volume for large variations of temperature, and for both the liquid and gaseous states, is well expressed by Lorentz's formula, $C = (x_2 - 1)/(x_2 - 2) \cdot v = 0.3025$.

If the substance is not stirred, it may be assumed that at a tempe-

perature a few degrees below the critical, the refractive index in each layer is the same at the same phase, but as the temperature approaches the critical, the refractive indices of the lower layers tend to become greater. Above the critical temperature, the mean value of the refractive indices of the various layers is that corresponding with the total volume of substance.

E. W. W.

Conditions Determining the Stability of Rotatory Power. By JOSEPH A. LE BEL (*Compt. rend.*, 1900, 130, 1552—1555).—The existence of optical rotation in a chemical compound depends, not only on the asymmetric disposition of at least four dissimilar radicles around a central atom, but also on the stability of the geometric system; the mobility of the substituent radicles produces a loss of optical activity by racemisation.

The stability of an asymmetric system increases with (1) the chemical activity of the central element, (2) the specific volume of the substituent radicles.

The chemical activity of carbon is greater than that of nitrogen, and hence the compounds containing the former element in an asymmetric condition are sufficiently stable to exhibit optical activity at the ordinary temperature; this, however, is not always the case with asymmetric nitrogen. Even with asymmetric carbon compounds containing small radicles, the activity readily disappears; the optical rotation of amyl alcohol is diminished by converting it into its sodium derivative at the ordinary temperature; its rotation greatly decreases on heating it at 100° or 150°, and at 200° it is completely racemised.

The failure to obtain active forms of the salt $\text{NHMeEtPr}\cdot\text{Cl}$ is very probably due to the mobility of its light radicles; the compound $\text{C}_{10}\text{H}_{24}\text{NCl}$, obtained by adding methyl to each of these radicles, exhibits optical isomerism, the rotation diminishing as the temperature rises. The salts of the C_{10} bases are, however, less stable than those employed by Pope and Peachey, which contain 17 carbon atoms (*Trans.*, 1899, 75, 1127).

The stability of active substances also depends on the chemical influence exerted by the substituent radicles on one another; it is therefore considerably modified by the replacement of one radicle by another of a different chemical nature: for example, the bromosuccinic acid, obtained by replacing hydroxyl by bromine in malic acid, racemises at the ordinary temperature.

These results indicate that at 100° the presence of four dissimilar radicles attached to a carbon atom is not in itself sufficient to determine the existence of optical rotation, for at this temperature sodium amyloxide and bromosuccinic acid resemble the compounds of active nitrogen, and readily undergo racemisation.

G. T. M.

Solidification and Transition Phenomena of Optical Antipodes. By J. H. ADRIANI (*Zeit. physikal. Chem.*, 1900, 33, 453—476).—The distinction between racemic and pseudoracemic compounds is not as simple as many observers consider; contrary to the opinion of Kipping and Pope (*Trans.*, 1897, 71, 989), the crystallographic form of a racemic compound may be very similar to that of the active components, whilst further, a pseudoracemic compound may be different

in crystallographic form, density, &c. The author considers that there is no satisfactory proof of the existence of a racemic compound in the liquid state as change of volume and production of heat which have been taken as indication of the formation of a racemate also occur when no chemical action takes place; similar doubts also apply regarding the gaseous state. The most satisfactory test for a racemic compound is the complete examination of the melting point curve for mixtures of the two antipodes, and these curves are given for dimethyl tartrate, dimethyl diacetyltartrate, mandelic acid, benzoyltetrahydroquinoline, camphoroxime, and carvoxime. The first four curves, each consisting of three portions with a central maximum, are typical of the formation of racemic compounds as described by Roozeboom; the fifth is a straight line, and the sixth a continuous curve with a maximum. The last two curves hence indicate a series of mixed crystals, but in the last case no statement can be made regarding the existence of a racemic compound. The transition temperatures were also determined for the whole series of the camphoroxime mixtures, and it was found that the continuous series of the β -modification changes into a continuous series of the α -modification, the transition curve being continuous with a central minimum. Although only mixed crystals may exist at the melting point, yet it is possible that racemic compounds may exist at the ordinary temperature, and it is shown that this is probably the case with carvoxime (compare Roozeboom, this vol., ii, 64, 70, 132).

L. M. J.

Asymmetry and Vitalism. By C. ULPANI and S. CONDELLI (*Gazzetta*, 1900, 30, i, 344—382).—A discussion of Japp's Sectional Address at the British Association in 1898 and of the controversy to which it gave rise. The views of Pasteur, Peré, Hahn, and Fischer are also discussed. The authors find that whilst *Penicillium glaucum* destroys *l*-lactic acid, *d*-alanine, and *d*-tartaric acid, the cholera bacillus attacks *d*-lactic acid, *l*-alanine, and *d*-tartaric acid; these results throw doubt on Japp's biological theory of the propagation of life in an asymmetric sense.

T. H. P.

The Lead Accumulator. By MARTIN MUGDAN (*Zeit. Elektrochem.*, 1899, 3, 309).—The author shows that, when an accumulator is discharged, lead sulphate separates on both the positive and negative plates in almost theoretical quantity, and that no lead oxide is formed. If sodium sulphate is used as the electrolyte in place of sulphuric acid, however, some lead oxide is formed on the positive plate. A partially oxidised negative plate takes up sulphuric acid very slowly, whereas a positive plate containing oxide absorbs the acid very rapidly. The potential difference between a negative (spongy lead) plate and sulphuric acid of given concentration is independent of the quantity of lead sulphate on the plate. The alterations in the E.M.F. of an accumulator during charge and discharge are due to local changes of the concentration of the acid at the electrodes. When at rest, the condition of affairs may be represented thus: $\text{Pb, PbSO}_4 \mid \text{acid} \mid \text{PbSO}_4, \text{PbO}_2$. During charge, the acids at the electrodes are more, but during discharge, are less concentrated than the main bulk of the acid. The total E.M.F. is therefore obtained by

superimposing the E.M.F.'s of two concentration cells on the main E.M.F. The two concentration cells may be represented thus: $\text{Pb}, \text{PbSO}_4 \mid \text{dil. or conc. acid} \mid \text{acid} \mid \text{PbSO}_4, \text{Pb}$ and $\text{PbO}_2, \text{PbSO}_4 \mid \text{dil. or conc. acid} \mid \text{normal acid} \mid \text{PbSO}_4, \text{Pb}$. The E.M.F.'s of these concentration cells are calculated from Nernst's theory (see Dolezalek, this vol., ii, 2), and compared with actual measurements made by the author. For acids containing less than 0.75 gram-mol. per litre, the agreement is excellent. A change of concentration at the lead dioxide plate makes about 1.4 times as much difference in the E.M.F. as an equal change at the lead plate. Further, the concentration of the acid at the lead dioxide plate increases or decreases during charge and discharge $1 + \frac{2v}{u}$ times as quickly as that at the lead plate (u and v are the relative mobilities of the H and SO_4 ions). The effect of the changes of concentration at both electrodes is to diminish the E.M.F. of the cell during discharge and increase it during charge.

T. E.

Chemical Equilibrium and Electromotive Force. By H. DANNEEL (*Zeit. Elektrochem.*, 1899, 6, 293).—From theoretical considerations, the author draws the conclusion that, when a metal is precipitated from a solution of one of its salts by another metal, the ratio of the concentrations of the ions of the two metals in the solution when equilibrium is attained is the same as the ratio of the solution tensions of the two metals. This conclusion is tested experimentally in the case of the precipitation of silver from a solution of silver iodide in hydriodic acid by hydrogen. The concentration of the hydrogen ions when equilibrium is attained is calculated to be 0.057 gram-mol. per litre at 18° , whilst the concentration 0.042 at 13° is found experimentally. The further conclusion is drawn that, in reactions of this kind, the final equilibrium is independent of the nature of the anion.

T. E.

Additivity of Atomic Heats. By STEFAN MEYER (*Ann. Physik.*, 1900, 2, 135—140).—By the comparison of the molecular heats and molecular volumes of a large number of compounds with the sum of the atomic heats or atomic volumes of the components, it is seen that the molecular heat is only equal, or approximately equal, to the sum of the atomic heats in those cases where the molecular volume is also equal or approximately equal to the sum of the atomic volumes, and the differences in the two cases are, moreover, in the same sense.

L. M. J.

Boiling Point Curves. By CLARENCE L. SPEYERS (*Amer. Jour. Sci.*, 1900, 9, 341—344).—The expression $n_1/(n_2 + n_1) = (p - p')/p$, previously used by the author for the determination of molecular weights in liquid mixtures (Abstr., 1899, ii, 145), may also be used to calculate the boiling point curves of the latter if the states of molecular aggregation of the components are known. The curves so calculated agree well with the experimental determinations in the case of mixtures of carbon tetrachloride with benzene or chloroform; for benzene and chloroform, however, the agreement is not so good, but fair accord was obtained for mixtures of benzene and ethyl

alcohol, where complex molecules are known to occur. If the molecular weights of the components are normal, the curves will be straight lines if $dp_1/dt_1 = dp_2/dt_2$, while if $dp_2/dt_2 > dp_1/dt_1$, the curve will be convex or concave to the axis of abscissæ according as $p_2 >$ or $< p_1$. A mixture cannot have a minimum boiling point unless one or both components have abnormal molecular weights. In the first case, a minimum would probably occur when the constituent with the lower vapour pressure is associated; in the latter case, absence of a minimum would be exceptional, although possible. L. M. J.

Phenomenon Noticed in the Cooling of Superfused Substances. By R. MORESCHINI (*Gazzetta*, 1900, 30, i, 339—344).—Mixtures of fatty acids obtained from soap exhibit the phenomenon of superfusion, the temperature at which resolidification occurs varying with the method of determination employed. When such a mixture is heated in a tube to, say, 15° above its melting point, and then allowed to cool in a constant temperature air-bath, conveniently 15° below the melting point, the rate of cooling diminishes regularly until the melting point is reached, when a sudden diminution takes place; cooling afterwards proceeds regularly, although more slowly than before. In the case of pure substances, however, this sudden change in the rate of cooling occurs just at the melting point, whilst with mixtures of fatty acids, especially if much oleic acid is present, it appears at a temperature about 0.15° above the melting point.

T. H. P.

Determination of the Transition Temperature of Monotropic Dimorphous Substances. By RUDOLF SCHENCK (*Zeit. physikal. Chem.*, 1900, 33, 445—452).—In the case of a monotropic dimorphous substance, the transition temperature lies above the melting point, and hence cannot be directly determined. If the melting points of the two modifications be lowered by the addition of a foreign substance, the depression will be less for the stable form, in consequence of the smaller value of the latent heat of fusion—if curves be drawn for melting point against concentration of foreign substance, the curves, by extrapolation, will meet at a certain negative concentration and higher temperature. For this concentration, there is no physical interpretation, but the author considers the temperature to be the transition temperature of the compounds. By this means, the transition point of *m*-nitro-*p*-acetyl-toluidine was found to be 105.9° , the melting points of the two modifications being 93.32° and 91.58° . For monochloroacetic acid, the melting points of the two varieties of which were found to be 56.3° and 61.5° , no result could be obtained, owing to the very slight difference between the depression constants.

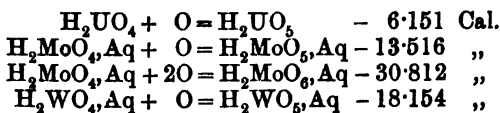
L. M. J.

Apparatus for Determining the Calorific Value of Fuels. By GAETANO MAGNANINI and V. ZUNINO (*Gazzetta*, 1900, 30, i, 395—401).—A modified form of Lewis Thompson's calorific bomb is described, the use of an oxidising mixture to burn the fuel being obviated, and the combustion carried on in a regular stream of oxygen. A series of 15 different samples of coal were examined in the new

apparatus and good results obtained, the calorific values found being in every case but two higher than the numbers yielded by the Lewis Thompson method.

T. H. P.

Thermochemistry of Hyperacids. By L. PISSARJEWSKY (*J. Russ. Phys. Chem. Soc.*, 1900, 32, 155—169).—The following heats of neutralisation by sodium hydroxide of acids of the elements of the sixth series in Mendeleeff's table have been determined: Pyrouroanic acid, $\text{H}_2\text{U}_4\text{O}_7$, +17·559 Cal.; tungstic acid, H_2WO_4 , +13·698 Cal.; permolybdic acid, H_2MoO_5 , +13·248 Cal.; molybdic acid, H_2MoO_4 , +21·278 Cal. Comparing the heats of neutralisation of molybdic and tungstic acids with the value, +24·720 Cal., for chromic acid, it is seen that as the atomic weight of the element of this series increases, the acid function of the corresponding acid decreases. The following heats of reaction were also determined:



T. H. P.

Absorption. VI. Absorption of Matters from Solution. By JACOBUS M. VAN BEMMELN (*Zeit. anorg. Chem.*, 1900, 23, 321—372).—In the partition of a crystalloid between a colloid or porous substance and the liquid solution, the ratio of the concentrations may be greater than, equal to, or less than, unity; the last case, termed by the author negative absorption, has been observed when kaolin is added to a solution of salt, the concentration of the latter in the solution being thereby increased. The absorption of the crystalloid is influenced by various factors. (1) By the structure and state of the colloid; thus, red colloidal manganese peroxide absorbs more acid or salt from an aqueous solution than does the black, and the absorptive power of stannic or metastannic acid is dependent on its condition. (2) By the nature of the solvent, picric acid is absorbed by silk in greater quantity from an aqueous solution than from an alcoholic solution, and not at all from a benzene solution; this is not merely due to the solubility in the different solvents, as picric acid is more soluble in alcohol than in either of the other two. (3) By the nature of the solute; the metastannic acid hydrogel, for example, absorbs potassium chloride but slightly, but hydrogen chloride very strongly. (4) By the molecular state of the solute in the solutions, and (5), by the temperature. The case of the absorption of two compounds from a solution by a colloid is greatly complicated by the influence of each on the absorption of the other, and of the compounds produced by their interaction. In the colloid, hydrolysis frequently occurs even in the case of salts of strong acids or bases, as, for instance, potassium sulphate or chloride, from solutions of which various hydrogels absorb an excess of base (compare this vol., ii, 338; *Abstr.*, 1899, ii, 12, 84, 487).

L. M. J.

Theory of Capillarity. By G. BAKKER (*Zeit. physikal. Chem.*, 1900, 33, 477—499).—The author considers the usual treatment and

derivation of the laws of capillarity to be unsatisfactory, and gives a different method for their derivation, but without deducing any important new results.

L. M. J.

Solution Tension of Zinc in Ethyl Alcohol. By HARRY C. JONES and ARTHUR W. SMITH (*Amer. Chem. J.*, 1900, 23, 397—403).—Jones's experiments (Abstr., 1894, ii, 374) have shown that the solution tension of silver is considerably less in alcoholic than in an aqueous solution of its salts. As the solution tension of silver is very small, the authors have extended the investigations to zinc, the solution tension of which is very great. The dissociation of a $N/10$ solution of zinc chloride in ethyl alcohol was found by the boiling point method to be 6.5 (this vol., ii, 187); Kahlenberg had found the E.M.F. of the chain zinc | aqueous $N/10$ zinc chloride | alcoholic $N/10$ zinc chloride | zinc to be 0.19 volt, from which the value 1.9×10^{10} atmos. is obtained for the solution tension of the zinc in alcohol. By the determination of the E.M.F. of the alcoholic electrode alone (0.327 volt), the value 2.7×10^{-10} atmos. is obtained for the solution tension, agreeing fairly with the previous value, and about 10^{-8} times the solution tension in water, so that metals cannot be regarded as possessing a definite solution tension independent of the solvent.

L. M. J.

Changes of Solubility by Addition of Salts. By VICTOR ROTHMUND (*Zeit. physikal. Chem.*, 1900, 33, 401—414).—Although it is frequently assumed that the addition of a salt should have no effect on the solubility of a non-electrolyte in water, yet Gordon (Abstr., 1896, ii, 154) and Roth (Abstr., 1898, ii, 18) have shown that the solubility of gases in water is diminished by the addition of salts, and Euler has shown that the solubility of ethyl acetate is similarly decreased (this vol., ii, 196), and to about the same extent, the relative order of the salts examined being also similar in the various cases. The author has determined the influence of the addition of salts on the solubility of phenylthiocarbamide, and curves are given for salt concentration against solubility, these curves being approximately straight lines. The sulphates and carbonates produce the greatest depression, the equivalent solubility depression being about 0.4; nitrates were found to have the least effect, ammonium nitrate causing an increase of solubility, whilst the order of the salts is also the same as that found for carbon dioxide, hydrogen, nitrous oxide, and ethyl acetate. The equivalent solubility depression $1/n \cdot (s_0 - s)/s_0$ was found to be independent of temperature, hence s/s_0 is constant, so that $d \log s / dT = d \log s_0 / dT = q / 2T^2 = q_0 / 2T^2$, where q is the heat of solution, which is hence the same in salt solutions as in pure water.

L. M. J.

Chemical Kinetics and Free Energy of the Reaction
 $2\text{HI} + 2\text{Ag} \rightleftharpoons 2\text{AgI} + \text{H}_2$. By H. DANNEEL (*Zeit. physikal. Chem.*, 1900, 33, 415—444).—The E.M.F. of a cell consisting of silver and hydrogen electrodes in normal solutions of the corresponding ions is 0.78 volt, and hence it follows that the E.M.F. of any similar cell is $0.78 + 0.058 \log C_{\text{Ag}}/C_{\text{H}}$ volts where C_{Ag} and C_{H} are the concentrations of the silver and hydrogen ions. The solubility of silver iodide is

not known with certainty, but accepting the value 10^{-8} , it follows that at the concentration $C_H = 0.053$ the E.M.F. of the cell is zero, and equilibrium obtains. The equilibrium concentration obtained by direct experiment was 0.043, a value which gives $0.567 + 10^{-8}$ as the solubility of silver iodide, a value lower than those previously obtained by other methods. The reaction-velocities in each direction were determined; the values indicate that the reaction proceeds as $Ag + HI \rightleftharpoons AgI + H$, so that the hydrogen takes part in the reaction as H , not as H_2 . The equilibrium constant calculated from the reaction velocities is in complete accord with the direct determination. The value of the E.M.F. of any similar cell is $0.1154 \log C/C_0$, where C is the actual and C_0 the equilibrium concentration of the hydrogen, but the values experimentally obtained are not in accord with those so calculated, an almost constant difference of 0.02 volt being found. No explanation could be given, although it is pointed out that a higher pressure of hydrogen in the electrode would cause such a difference.

L. M. J.

Reactions in Water and Acetone. By PAUL ROHLAND (*Chem. Zeit.*, 1900, 24, 312—314).—Owing to differences in the extent of the dissociation and in solubility, many reactions proceed differently in aqueous and acetone solutions. The colour of dilute solutions of copper salts is alike in both solvents, but with moderately strong solutions the colour differs, owing to the smaller value of the dissociation in acetone. The velocity of an ionic reaction may also be very small; thus silver nitrate and sodium dichromate gave no precipitate until the lapse of 30 seconds or more, whilst the precipitates frequently differ from those obtained in aqueous solutions, being probably allotropic forms. Anomalous reactions as those previously recorded (*Abstr.*, 1899, ii, 144) may occur, and fresh examples are given. Many reactions dependent on particular ions, as, for example, the action of hydroxyl compounds on the halogens, and on various indicators, may not occur in acetone solutions, owing to the absence of the particular ion involved.

L. M. J.

Behaviour of Perfumes with Liquid Air. By HUGO ERDMANN (*J. pr. Chem.*, 1900, [ii], 61, 225—228).—Preliminary experiments show that some perfumes lose their odour more or less completely when dissolved in liquid air, but on shaking the flask the odour is strongly apparent. The perfumes dissolved in liquid air therefore evaporate with it; hence it is possible that the volatility of any perfume does not depend alone on its vapour tension, but also on its specific solubility in air.

R. H. P.

Apparatus for Sublimation. By C. N. RIIBER (*Ber.*, 1900, 33, 1655—1657).—The author describes an apparatus for subliming substances under reduced pressure. For heating the apparatus, a Lothar Meyer air-bath, or simply two iron dishes fitting into one another, but separated by a layer of air and covered with an asbestos lid, may be employed. The apparatus itself consists of a horizontal glass cylinder ground into a glass cup, in which the substance to be sublimed is placed, the upper end of the cylinder is drawn out into

a narrow tube, which can be attached to the pump. The process of sublimation is quickened if the cup and cylinder do not fit quite airtight, as a gentle current of warm air is thus kept passing over the substance. The apparatus may also be employed for separating two substances of different volatility, for the estimation of water of crystallisation, &c.

J. J. S.

Lecture Experiments Illustrating Equilibrium and Dissociation. By JULIUS STIEGLITZ (*Amer. Chem. J.*, 1900, 23, 404—408).—The effect of excess of one of the products on the dissociation of a compound is easily seen by heating two tubes containing bromine with (1) an equivalent quantity, and (2) an excess of phosphorus tribromide. It is still more marked if phosphorus bromodichloride be used, and the difference between this and the previous case forms an illustration of the different magnitudes of dissociation constants. The decrease of electrolytic dissociation, on addition of one of the ions, is well seen on adding an ammonium salt to a solution of phenolphthalein coloured red by a few drops of a dilute ammonia solution, the red colour almost disappearing in consequence of the decrease of concentration of the hydroxyl ions. A somewhat similar result is obtained by the addition of an acetate to a solution of methyl-orange reddened by a drop of acetic acid.

L. M. J.

Inorganic Chemistry.

Limits of Combustibility of Hydrogen and Gaseous Hydrocarbons when Diluted with Large Volumes of Air and Passed over Red Hot Cupric Oxide. By ARMAND GAUTIER (*Compt. rend.*, 1900, 130, 1353—1360).—Definite mixtures of hydrogen or methane or both with air previously freed from hydrogen and carbon compounds, were passed slowly through two consecutive tubes containing cupric oxide heated just to redness. With two tubes each 35 cm. long, hydrogen is completely oxidised even when diluted with 5000 times its volume of air, but it is noteworthy that only 70 per cent. of the oxidation takes place in the first tube.

Methane, however, under similar conditions, is incompletely burnt. With two tubes each 30 cm. long and a dilution of 1 in 4000, 71·6 per cent. of hydrogen and 58·9 per cent. of the carbon are burnt; with a dilution of 7 in 100,000, 45·2 per cent. of hydrogen and 36 per cent. of carbon. With methane, 16 parts, and hydrogen, 8 parts, in air, 100,000 parts, all the free hydrogen, 58·3 per cent. of the hydrogen in the methane, and 47·4 per cent. of the carbon in the methane are burnt. It would seem, therefore, that the presence of free hydrogen promotes the oxidation of the hydrogen of the methane. The use of a third tube of cupric oxide, even 80 cm. long, has no appreciable influence on the results obtained with mixtures of hydrogen and hydrocarbons.

C. H. B.

Higher Hydrogen Peroxides. By A. BACH (*Ber.*, 1900, 33, 1506—1517).—Whilst hydrogen dioxide, H_2O_2 , when reduced with potassium permanganate, gives $5O_2$ for each $2KMnO_4$, hydrogen tetroxide, H_2O_4 , should give $10O_2$ for each $2KMnO_4$. The method adopted in order to detect the presence of higher hydrogen peroxides consisted in measuring the volume of gas liberated in the titration with potassium permanganate and comparing it with that calculated from the ratio $2KMnO_4:5H_2O_2$. The proportion of gas found in titrating hydrogen peroxide from different sources was as follows :

From barium peroxide.....	1
„ oxidation of palladium hydride.....	1·07
„ sodium dioxide	1·17
„ potassium tetroxide	1·28
„ a mixture of hydrogen peroxide with two volumes of concentrated sulphuric acid...	1·65

From these results, the existence of a higher hydrogen peroxide is assumed, and the formula H_2O_4 is assigned to it from analogy to K_2O_4 , and also because H_2O_2 is regarded as a substance which would probably have no oxidising power.

T. M. L.

[The large volume of oxygen produced from a mixture of hydrogen peroxide and sulphuric acid is readily explained by the presence of a 'persulphuric acid' in the mixture; this was demonstrated by Berthelot as long ago as 1878, and it was found that, whilst it does not reduce potassium permanganate, it is readily hydrolysed to sulphuric acid and oxygen.—T. M. L.]

Evolution of Chlorine by the Aid of Manganese Dioxide. By LEONHARD WACKER (*Chem. Zeit.*, 1900, 24, 285).—Manganese dioxide or one of its hydrates is obtained when chlorine gas is passed into a solution of crystallised manganese chloride in concentrated hydrochloric acid for some hours, and the dark coloured liquid thus obtained poured into warm water. The author thinks that this confirms the conclusion that manganese tetrachloride is the first product formed by the action of hydrochloric acid on manganese dioxide (compare Meyer and Best, this vol., ii, 77).

J. J. S.

Electrolytic Preparation of Hypochlorites. By ADOLF SIEVERTS (*Zeit. Elektrochem.*, 1900, 6, 364, 374).—The experiments were made in order to decide whether the yield of hypochlorite in the electrolysis of solutions of the chlorides of the alkali or alkaline earth metals is increased by an increased current density. Oettel had observed an increased yield with the electrolyte at rest, and Schoop a decreased yield with a flowing electrolyte. In the author's experiments, the solution flows at constant speed through the cell, the quantity of hypochlorite formed after the passage of a definite quantity of electricity at varying current density being determined. An increased yield was observed at higher current densities both with sodium and potassium chlorides. The yield of hypochlorite is very good at the beginning of an experiment, when its concentration in the solution is small, but it decreases rapidly (owing to cathodic reduction) as the concentration rises.

Further experiments were made in order to decide whether the superior bleaching properties of electrolytic hypochlorite solutions are due to the presence of free hypochlorous acid. The free hypochlorous acid present is determined by a method due to Jorre, depending on the reactions $\text{MOCl} + \text{H}_2\text{O}_2 = \text{MCl} + \text{H}_2\text{O} + \text{O}_2$ and $\text{HOCl} + \text{H}_2\text{O}_2 = \text{HCl} + \text{H}_2\text{O} + \text{O}_2$. The hydrogen chloride liberated is finally titrated. The following table contains the principal results. The solutions were all treated in the same way and the time which they required to bleach a piece of turkey red cloth noted.

Grams salt per 100 c.c.		Hypochlorite current efficiency.	Per cent. of HOCl free.	Time of bleaching.	Per cent. of hypochlorite undecomposed after 24 hours.
10	grams NaCl.....	51.7	0	5½ hours	98
12.7	„ KCl	44.4	0	4 „	98
9.5	„ CaCl_2 ...	73.4	49.3	15 min.	45
3.48	„ MgCl_2 }	62.1	94.9	10 „	90
+ 8	„ NaCl }				

The effect of the presence of free hypochlorous acid is quite clear. A solution of pure magnesium chloride gave a liquid which readily decomposed, contained free chlorine, and was not further investigated.

T. E.

Electrolytic Formation of Chlorates. By HEINRICH WOHLWILL (*Zeit. Elektrochem.*, 1900, 6, 410).—A continuation of the discussion with Förster (see Abstr., 1899, 278; this vol., ii, 72, 400). T. E.

Chlorine Heptoxide. By ARTHUR MICHAEL and WALLACE T. CONN (*Amer. Chem. J.*, 1900, 23, 444—446).—The method described by Roscoe (*Trans.*, 1863, 16, 82) for the preparation of perchloric acid is improved by heating the perchlorate and sulphuric acid under 10—20 mm. pressure. Perchloric acid boils at 19° under 11 mm. pressure. When it is mixed with alcohol or ether, no explosion occurs; it dissolves in benzene, forming a green solution which gradually becomes charred. Iodine dissolves in the acid with the production of a dark solution which, on exposure to bright light, becomes converted into a white solid; when this white substance is heated, it is decomposed into iodine and iodic acid (compare Vorländer and Schilling, this vol., ii, 340).

Chlorine heptoxide is obtained by slowly adding perchloric acid to phosphoric oxide cooled below -10° ; the mixture is left for a day and then gradually warmed until the new oxide distils over. It is a colourless, very volatile oil, which boils constantly at 82° under ordinary pressure; on standing for 2—3 days, it becomes greenish-yellow and evolves a greenish gas. It explodes violently on percussion or when brought into a flame, but is without action on wood or paper. By the action of water on the oxide, it is gradually converted into perchloric acid. It dissolves in dry, well-cooled benzene and slowly attacks it. It reacts with iodine with liberation of chlorine and formation of a white substance which is probably iodine heptoxide; this decomposes at 380° with the production of iodine and oxygen. Chlorine heptoxide is not, however, similarly attacked by bromine.

E. G.

Preparation, Properties, and Analysis of Thionyl Fluoride. By HENRI MOISSAN and PAUL LEBEAU (*Compt. rend.*, 1900, 130, 1436—1442. Compare this vol., ii, 341).—Thionyl fluoride, which was first obtained by Meslans (*Bull. Soc. Chim.*, 1896, [iii], 15, 391), is most conveniently prepared by mixing together arsenic trifluoride (2 mols.) and thionyl chloride (3 mols.) and heating the mixture at 100°; it is separated from arsenic trichloride and traces of its generators by fractional distillation at low temperatures. It is also produced by the action of fluorine on thionyl chloride; this reaction, however, is somewhat complicated, and the thionyl fluoride is contaminated with chlorine and a more volatile sulphur oxyfluoride which is not absorbed by water.

Thionyl fluoride is a colourless gas which boils at -32°, fumes slightly in moist air, and has a suffocating odour; it has no action on mercury at the ordinary temperature. Its composition was determined both by synthesis from weighed quantities of its generators and also by volumetric and gravimetric analyses. The volumetric determination was made by heating the gas in a dry glass vessel at 400°; under these conditions, 4 vols. of the gas yield 6 vols. of gaseous products in accordance with the following equation, $2\text{SOF}_2 + \text{SiO}_2 = \text{SiF}_4 + 2\text{SO}_2$. Its decomposition by water ($\text{SOF}_2 + \text{H}_2\text{O} = \text{SO}_2 + \text{H}_2\text{F}_2$) furnishes a method for the gravimetric analysis, the sulphurous acid being estimated iodometrically and the fluorine by precipitation as calcium fluoride. The gas is soluble in arsenic trichloride, ether, turpentine, or benzene, and is absorbed by fused sodium or tin; when treated with hydrogen chloride over mercury, a gaseous mixture is produced which gradually attacks this metal.

The action of the electric discharge from an induction coil on thionyl fluoride contained in glass vessels is similar to that of heat; when this decomposition takes place in the presence of hydrogen, the sulphur dioxide produced undergoes reduction, and hydrogen sulphide, sulphur, and water are produced; the last named reacts with the silicon fluoride, giving rise to a small quantity of hydrofluosilicic acid.

The presence of oxygen does not affect the decomposition of the thionyl compound as produced by the action of heat, but when a mixture of the two gases is submitted to the action of the induction spark a certain amount of the more volatile sulphur oxyfluoride is produced. Sulphur and phosphorus do not act on the gas at 500°; water, hydrogen fluoride, and sulphur are produced by the action of hydrogen sulphide at high temperatures; there is, however, no interaction in the cold.

Ammonia is absorbed by thionyl fluoride, yielding first an orange compound having the composition $2\text{SOF}_2 \cdot 5\text{NH}_3$, and finally a white substance corresponding with the fixation of 7NH_3 by 2SOF_2 ; when treated with hydrogen chloride, the latter product is decomposed, giving rise to sulphur dioxide and sulphur. G. T. M.

Estimation of Sulphuric Acid in the Presence of Iron: Solid Solution and the Hydrolysis of Chromium and Iron Salts. By THEODORE W. RICHARDS (*Zeit. anorg. Chem.*, 1900, 23, 383—390).—The paper contains a theoretical criticism of Küster

and Thiel's work on the estimation of sulphuric acid in the presence of iron (Abstr., 1899, ii, 247, 611; this vol., ii, 242). Since a precipitate of calcium carbonate obtained in a solution saturated with salt contains only 0.1 per cent. of sodium chloride, it is evident that the precipitation of impurities together with barium sulphate which amount to several per cent. is a different phenomenon. This the author calls *occlusion* to distinguish it from mechanical inclusion, and compares it with the occlusion of hydrogen by palladium. Aluminium sulphate and green chromium sulphate are also occluded by barium sulphate. The occlusion is probably brought about by the formation of an electrically neutral substance or complex. The nature of the groups which cause the occlusion in the case of iron, chromium, and aluminium salts is not determined, but they are probably of a basic character and similar to the basic complex described by Racoura (Abstr., 1896, ii, 27) and Whitney (Abstr., 1896, ii, 525). The green chromium sulphate solution probably contains not only a basic complex, but also a chromosulphuric acid which is not precipitated by barium solutions and is only slightly occluded by barium sulphate as it is strongly dissociated.

E. C. R.

Spontaneous Decomposition of Thiosulphuric Acid. By ARNOLD F. HOLLEMAN (*Zeit. physikal. Chem.*, 1900, 33, 500—501. Compare van Oettingen, this vol., ii, 400).—The author had previously shown that opalescence must not be regarded as the first indication of the decomposition of thiosulphuric acid, for if the solution is neutralised before opalescence is produced, it still occurs later. The decomposition is also not necessarily entirely due to hydrogen and S_2O_3 ions, as there is no evidence against the view that the undissociated molecules are also reactive.

L. M. J.

Tellurium. By F. D. CRANE (*Amer. Chem. J.*, 1900, 23, 408—425).—Tellurium may be obtained from the dross produced in the final purification of the precious metals from the electrical refining of copper (compare Whitehead, Abstr., 1896, ii, 164) by extracting it with hydrochloric acid and precipitating by means of sodium hydrogen sulphite. In order to remove selenium, the precipitate is allowed to act as the positive pole of an electrolytic cell containing hydrochloric acid; the nascent chlorine effects the solution of the tellurium, the selenium remaining undissolved. Further purification is carried out by boiling the precipitated tellurium with a reserve portion of the solution from which it has been obtained, in order that any metallic elements with which it may be contaminated may be dissolved and an equivalent quantity of tellurium precipitated.

Keller (Abstr., 1898, ii, 638) has stated that selenium and tellurium may be separated by means of ferrous sulphate, the selenium being precipitated, whilst the whole of the tellurium remains in solution. The author finds that this is only true if the tellurium is present entirely as tetrachloride, for if the solution contains any dichloride, some tellurium is always precipitated. When tellurium is added in excess to a mixture of selenium dichloride and tellurium tetrachloride

dissolved in hydrochloric acid, the selenium becomes completely replaced by tellurium, and is thus removed from the solution.

Tellurium tetrachloride dissolves in water, forming a yellow solution; when this solution is diluted, it yields a precipitate of tellurous acid, which gradually changes into the crystalline dioxide. If a metal, such as iron, arsenic, or antimony, is present, the precipitate appears to consist of a double oxychloride. E. G.

Some Properties of Liquid Ammonia. By C. FRENZEL (*Zeit. Elektrochem.*, 1900, 6, 477, 487, and 493).—The author has determined certain properties of very carefully purified liquid ammonia. The specific conductivity of the purest ammonia obtained was 1.33×10^{-7} ohms per cm. at -79° . The conductivity increases 1.9 per cent. of its value at 60° per degree rise of temperature. The conductivity increases and the temperature coefficient decreases with increasing impurity of the ammonia; in these particulars, it resembles water. By observations of the current which passes between a small cathode and a large anode through solutions of salts in ammonia when the applied E.M.F. is gradually increased, it is shown that there are three points at which anions, formed from the ammonia itself, are discharged. The author concludes that electrolytic dissociation of NH_3 into H^+ , NH_2^- , NH^- , and N^{3-} takes place. The addition of traces of water to liquid ammonia produces a comparatively very small increase in its conductivity. This is probably due to the fact that the greater part of the water remains uncombined, a very small portion forming NH_4OH . T. E.

Azoimide. By THEODOR CURTIUS and AUGUST DARAPSKY (*J. pr. Chem.*, 1900, [ii], 61, 408—422. Compare Curtius and Rissom, *Abstr.*, 1899, ii, 90).—The precipitation of aluminium hydroxide from a solution of ammonia-alum by sodium azoimide proceeds quantitatively if the azoimide set free is expelled by boiling. Chrome alum gives a green solution of chromium azoimide which is completely hydrolysed on boiling, the whole of the chromium being precipitated as hydroxide; a second *basic chromium azoimide* containing $1\text{Cr}:1\text{N}_3$ has been precipitated as a green salt from the solution by adding alcohol and ether. Ferric alum gives a blood-red solution of the azoimide which soon deposits a brown basic azoimide.

Zirconium and thorium give no azoimide, but are completely precipitated as hydroxides. Yttrium resembles chromium in that it gives a soluble azoimide, from which the hydroxide is precipitated on boiling. Lanthanum, cerium, and didymium give soluble azoimides, from which basic azoimides are precipitated on boiling containing 1La , Ce , or Di to 2N_3 . Uranium gives a much more stable azoimide, which is hydrolysed very slowly to uranyl hydroxide on boiling the solution.

On precipitating with alcohol and ether, manganese azoimide only gives the basic azoimide already obtained by evaporation, but *nickel azoimide*, $\text{NiN}_3 + \text{H}_2\text{O}$, is thrown down as a green, explosive powder, which dissolves again in water to a clear solution.

Arsenic dissolves in azoimide, but the azoimide is completely hydrolysed on evaporating the solution; antimony behaves similarly, but is only dissolved very slowly.

Azoimide is partially reduced to ammonia by zinc, and also by arsenic or antimony, but not by sodium amalgam; no hydrazine, hydroxylamine, or 'triimide' could be detected amongst the products of reduction.
T. M. L.

Preparation of Free Hydroxylamine. By RUDOLF UHLENHUTH (*Annalen*, 1900, 311, 117—120).—Although hydroxylamine oxalate yields the free base on distillation, the method is not suitable for the preparation of the purified substance, because water and carbon dioxide are produced at the same time. When hydroxylamine phosphate is distilled under reduced pressure, a very pure specimen of the base can be obtained; under 13 mm. pressure, distillation occurs at 135—137°, and the distillate solidifies almost immediately when the receiver is plunged into melting ice.
M. O. F.

Formation of Nitric Acid during Combustion: Carbon. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1900, 130, 1345—1353).—In the course of his researches on heats of combustion, the author has determined the quantities of nitric acid formed by the action of water and air on the nitrogen oxides produced during combustion in oxygen containing a small proportion of nitrogen, either at atmospheric pressure or in the calorimetric bomb. When amorphous carbon is burnt in the bomb under a pressure of 25 atmos. in oxygen containing 8 per cent. by volume of nitrogen, about 0.051 gram of nitric acid is formed per gram of carbon, although the actual amount varies with the rate of combustion, &c. The ratio of carbon dioxide to nitrogen is approximately $106\text{CO}_2 : \text{HNO}_3$. With graphite, under similar conditions, the quantity of nitric acid formed is only about one-fifth, and with diamond only about one-third of that formed in the case of amorphous carbon.

At the ordinary pressure in the same mixture of nitrogen and oxygen, even less than 1 milligram of nitric acid is formed per gram of amorphous carbon, whilst with air in place of oxygen, the proportion barely reaches 0.1 milligram per gram. Small though this amount is, the total quantity of nitric acid formed during the combustion of such substances as coal, petroleum, &c., must in the aggregate be very large. In the Department of the Seine it will amount to at least 8 kilograms of nitric acid per hectare per annum.
C. H. B.

Formation of Nitric Acid during Combustion: Sulphur, Metals. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1900, 130, 1430—1436. Compare preceding abstract).—When sulphur is burnt in atmospheric air or in oxygen containing 5—8 per cent. of nitrogen, a small amount of the latter element always undergoes oxidation; the results are therefore similar to those obtained in the combustion of carbon, although the amount of nitric acid produced when the action takes place in oxygen is much smaller. When the sulphur is burnt in compressed oxygen containing a small quantity of nitrogen, traces of ammonia can also be detected. The combustion of iron and zinc

under these conditions is not attended by the oxidation of nitrogen. The difference in the electrical properties of the combustibles and their oxides is suggested as the cause of this disparity. These phenomena were investigated quantitatively, and the paper contains a full discussion of the numerical data.

G. T. M.

Supposed Transformation of Phosphorus into Arsenic. By CLEMENS WINKLER (*Ber.*, 1900, 33, 1693—1697).—A destructive criticism of a paper by F. Fittica (*Leopoldina, Halle*, 1900, 36, 3, 40), in which it is stated that phosphorus can be partly transformed into arsenic by treatment with ammonium nitrate at 200°. Fittica's experiments have been repeated, and it is shown that the arsenic he obtained was really derived from impurities in the materials used.

R. H. P.

Dihydroxides. By ROBERT DE FORCEAND (*Compt. rend.*, 1900, 130, 1555—1558).—The addition of 1 mol. of hydrogen peroxide to aqueous solutions containing 2 mols. of sodium, potassium, or lithium hydroxides is attended by a heat disturbance of +5.821, +6.123, and +6.533 Cal. respectively; on adding a second mol. of the peroxide, more heat is developed, the additional amounts being respectively +4.845, +4.510, and +4.826 Cal. When ammonia and methylamine are substituted for these alkalis, the heat change, due to the first mol. of peroxide, is +0.589 and +2.584 Cal. respectively; the second molecule producing a further development of +0.464 and +1.464 Cal.

Appreciable thermal effects attend the addition of a third mol. of the peroxide to solutions of sodium and potassium hydroxides, the increments being +0.809 and +0.491 Cal. respectively; with lithium hydroxide, however, the change is only +0.005 Cal. These results point to the existence of compounds of the types $\text{NaO}\cdot\text{OH}$ and $\text{NaO}\cdot\text{ONa}$ and the heat of neutralisation of the acidic functions of hydrogen peroxide by various basic hydroxides can be calculated from the above data. The values of these constants are intermediate between those of the glycols and dihydric phenols. In the *m*- and *p*-dihydroxybenzenes, the heats of neutralisation of the first and second hydroxyl groups are approximately equal; the numerical values of these constants differ widely in the case of catechol and hydrogen peroxide which contain these radicles in close proximity to each other; the latter compound also resembles the phenols in its behaviour towards ammonia.

G. T. M.

Electrolysis of Sodium Chloride. By RICHARD LORENZ and H. WEHLIN (*Zeit. Elektrochem.*, 1900, 6, 389, 408, 419, 437, 445, and 461).—The authors have made a very elaborate investigation of the electrolysis of saturated solutions of common salt under conditions similar to those which occur in technical practice. The potential differences between platinum electrodes saturated with hydrogen, oxygen, and chlorine, and solutions containing sodium chloride, hypochlorite, hydroxide, and chlorate are also measured. In addition to determining the chemical effects of the current, the authors have made complete measurements of the electrical quantities necessary for an

exact understanding of the process, such as the polarisations at the electrodes, the reverse E.M.F.'s at the electrodes during the passage of the current, &c. The main results arrived at are as follows. The potential difference between an electrode of platinised platinum saturated with hydrogen and a solution of sodium chloride (saturated) + *N* sodium hydroxide is +0.52 volt. (The + sign indicates that the solution is at a higher potential than the electrode). In neutral solutions of salt, the potential difference is +0.12 volt, and the addition of sodium hypochlorite reduces it still further, owing to removal of hydrogen from the electrode, until in a concentrated solution of sodium hypochlorite the potential difference $\text{Pt}/\text{NaOCl} = -1.4$ volts is reached. In the electrolysis of neutral solutions of sodium chloride, the cathodic polarisations found immediately after breaking the circuit vary from -0.6 to -0.98 volt and thus correspond with the potential difference of the hydrogen electrode in solutions containing some hypochlorite. When alkaline solutions of sodium chloride are electrolysed, however, the cathodic polarisation changes sign and has values varying from +0.44 to +0.53 volt, thus again corresponding with the potential of the hydrogen electrode in alkaline solutions.

The E.M.F. required to produce decomposition at the cathode, or the reverse E.M.F. at the cathode during electrolysis, varies from +0.78 to +1.12 volts with polished platinum electrodes, whereas with platinised electrodes it varies from +0.25 to 0.62 volt. The authors conclude, therefore, that the evolution of hydrogen is a reversible process at the platinised cathode, but that a process analogous to supersaturation gives rise to the higher potential difference at the smooth cathodes. The great influence of the presence of sodium hypochlorite on the potential difference of the hydrogen electrode shows clearly the chemical reaction which takes place between hydrogen and hypochlorite at the cathode.

The changes at the anode are more complicated. The potential difference between a platinised platinum electrode saturated with chlorine, and a saturated solution of sodium chloride is about -1.58 volts. The addition of sodium hydroxide to the solution diminishes this value, so that in 2*N* sodium hydroxide the potential difference is -0.935 volt. An oxygen electrode in a saturated solution of sodium chloride gives the potential difference -0.9 volt, whilst in solutions containing sodium hypochlorite the potential difference varies irregularly and independently of the concentration of the hypochlorite from -1.4 to -1.5 volts; this is the potential difference between platinum and sodium hypochlorite solution. This shows that sodium hypochlorite is not oxidised by anodic oxygen, a result which is confirmed by chemical experiments. In the electrolysis of saturated neutral solutions of sodium chloride, the anodic polarisation observed after breaking the circuit varies from -1.66 to -1.53 volts, the lowest values being observed in the solutions containing the most hypochlorite; in alkaline solutions, the values vary from -1.35 to -1.31 volts. These numbers agree well with the potentials of the chlorine electrode in neutral and alkaline solutions, which proves that the anode is always saturated with chlorine even in alkaline solutions. It follows, therefore, that the formation of hypochlorite is due to the action of chlorine on dissolved alkali.

The reverse E.M.F. at the anode during electrolysis is very constant under the most varying experimental conditions. The platinised and smooth anodes give, however, different values, and there is also a very remarkable difference in their chemical behaviour. With a well platinised anode, the reverse E.M.F. is -1.75 volts, which is very nearly the potential of the chlorine electrode in saturated salt solution. The evolution of chlorine is, therefore, almost reversible, and it is found that practically no decomposition of water and no formation of chlorate takes place. With the smooth anodes, the reverse E.M.F. is -2.28 to -2.41 volts in neutral, and -2.26 to -2.3 volts in alkaline solutions. With these anodes, there is a considerable decomposition of water and simultaneous formation of chlorate. At the higher potential reached with the smooth anodes, it is probable that OH ions are discharged along with the chlorine ions, and that the formation of chlorate is due to their combination. The quantity of chlorate formed rises and falls with the potential difference at the anode. T. E.

Combination of Lithium Bromide with Gaseous Ammonia. By J. BONNEFOI (*Compt. rend.*, 1900, 130, 1394—1397. Compare Abstr., 1899, ii, 96).—Dry lithium bromide combines with gaseous ammonia to form four solid highly deliquescent compounds, the properties of which are summarised in the following table:

Composition.	Temperature of formation.	Heat of dissolution.	Heat of formation.	Dissociation pressure.	Variation of entropy $\frac{Q}{T}$.
LiBr, NH ₃	Above 95°	+6.857 Cal. at 15°	+13.298 Cal.	730 mm. at 95.5° 806 mm. at 97.5°	0.086
LiBr, 2NH ₃	Between 87° and 95°	+3.018 Cal. at 8°	+25.987 Cal.	665 mm. at 85° 847 mm. at 90°	0.084
LiBr, 3NH ₃	Between 71.5° and 87°	+0.287 Cal. at 10°	+37.463 Cal.	636 mm. at 67° 807 mm. at 71.8°	0.28
LiBr, 4NH ₃	About -18°	-1.548 Cal. at 8°	+45.098 Cal.	681 mm. at 56° 760 mm. at 58.3°	0.32

The heat developed by combination with the four successive molecules of ammonia is +13.293, +12.644, +11.526, and +10.635 Cal., and the relation between these values and the dissociation pressures agrees closely with Clapeyron's formula. The heats of formation given in the above table are the heats of formation from the solid salt and gaseous ammonia. C. H. B.

Lithium Peroxide. By ROBERT DE FORCRAND (*Compt. rend.*, 1900, 130, 1465—1468. Compare this vol., ii, 277, 344, 401, 479).—A *hydrated lithium peroxide*, Li₂O₂·H₂O₂·3H₂O, is precipitated in the form of hard, brilliant, colourless crystals on adding hydrogen peroxide and alcohol to a solution of lithium hydroxide. The heat of solution of this substance is -4.50 Cal., and its decomposition by hydrochloric acid is accompanied by a thermal change of 19.50 Cal.

The *anhydrous peroxide*, Li₂O₂, is obtained by drying the above hydrate for 8 days over phosphoric oxide; its heat of solution is 7.19 Cal., whilst its heat of formation from the monoxide is 3.64 Cal.

In the series lithium, calcium, strontium, and barium, the heat of

peroxidation of the monoxide increases, and the heat of formation of the monoxide decreases, as the atomic weight increases; these quantities vary to the same extent, but in opposite sense, and consequently the heat of formation of the peroxide is almost constant, its approximate value being 151. These properties tend to emphasise the relationship existing between lithium and the alkaline earth metals.

G. T. M.

Physical Properties of Cæsium. By MORITZ ECKARDT and EDMUND GRAEFE (*Zeit. anorg. Chem.*, 1900, 23, 378—382).—The following constants were determined: liquid cæsium has a sp. gr. 1·827 at 40° and 1·836 at 27°; solid cæsium has a sp. gr. 1·886 at 26°. The solidifying point is 26·37°; electrical conductivity, 3·63 at 27° ($\text{Ag} = 100$); specific heat, 0·04817; atomic heat, 6·406; heat of fusion = 3·73 cal. per 1 gram; contraction on solidification, 0·02627 per 1 c.c. or 2·627 per cent. by volume; coefficient of expansion, 0·0003948.

E. C. R.

Anhydrous Calcium Peroxide and the Constitution of its Hydrates. By ROBERT DE FORCAND (*Compt. rend.*, 1900, 130, 1388—1391. Compare this vol., ii, 277, 344, 401, 478).—Anhydrous calcium peroxide dissolves in dilute hydrochloric acid with development of +18·93 Cal., and hence $\text{CaO sol.} + \text{O} = \text{CaO}_2 \text{ sol.}$ develops +5·43 Cal.

The corresponding values for strontium and barium are +10·875 and +12·10 Cal. respectively, and here the stability of the peroxide and the possibility of preparing it by direct oxidation of the monoxide increase with the atomic weight of the metal, adopting Moissan's value for the heat of formation of calcium monoxide,

$\text{Ca sol.} + \text{O}_2 \text{ gas} = \text{CaO}_2 \text{ sol.}$ develops +150·43 Cal.,

which is higher than the corresponding value for strontium (+142·075 Cal.). The heats of formation of the hydrates are

$\text{CaO}_2 \text{ sol.} + 8\text{H}_2\text{O liq.} = \text{CaO}_2 \cdot 8\text{H}_2\text{O sol.}$ develops +15·636 Cal.

$\text{CaO}_2 \text{ sol.} + 8\text{H}_2\text{O sol.} = \text{CaO}_2 \cdot 8\text{H}_2\text{O sol.}$ „ +4·196 Cal.

The conversion of $\text{CaO}_2 \cdot 2\text{H}_2\text{O}$ into $\text{CaO}_2 \cdot 8\text{H}_2\text{O}$, however, develops +17·851 Cal., hence the formation of the first compound absorbs -2·215 Cal. This result can only be explained by assuming that $\text{CaO}_2 \cdot 2\text{H}_2\text{O}$ is not a hydrate of calcium peroxide, but a combination of the hydroxide with hydrogen peroxide, $\text{CaH}_2\text{O}_2 \cdot \text{H}_2\text{O}_2$. The heat of formation of this compound from its proximate constituents is -9·815 Cal., and its conversion into the true octohydrate of the peroxide involves changes of opposite signs, the true heat of hydration being +15·636, which corresponds with that of an unstable hydrate.

C. H. B.

Dehydration of Selenite and Hydration of Anhydrite. By V. ZUNINO (*Gazzetta*, 1900, 30, i, 333—339).—Pure precipitated calcium sulphate loses 18 per cent. of its water at 100°, and becomes completely anhydrous at 188°. When heated at 230° in a brisk current of steam, the anhydrous salt absorbs the whole of its water of crystallisation, whilst at 280° the water taken up—only 0·2 per

cent. of the total—is probably mechanically held by the salt. On heating a mixture of sodium chloride and anhydrous calcium sulphate to a white heat for 2 hours, and then cooling the fused mass slowly, small triclinic crystals of anhydrite are obtained. When calcium chloride is used in place of the sodium salt, the residue left after washing the mass with water showed in places signs of setting, which must be due to the conversion of anhydrite into gypsum by hydration. By prolonged boiling in saturated aqueous sodium chloride, the hydrated sulphate is partially converted into anhydrite crystals which by the continued action of water are transformed into gypsum. T. H. P.

Ammonium Earthy Phosphates. By LEONCE BARTHE (*Bull. Soc. Chim.*, 1900, [iii], 23, 422—425).—According to Kippenberger (*Grundlagen Nachweis Giftstoffen*, 1897, 222), the interaction of barium chloride, disodium hydrogen phosphate, and ammonia results in the formation of ammonium barium phosphate, NH_4BaPO_4 . The author is unable to confirm this statement, the precipitate obtained being found to have the composition BaHPO_4 . Attempts to prepare ammonium strontium phosphate were also unsuccessful, only the phosphates $\text{SrH}(\text{PO}_4)$ or $\text{Sr}_3(\text{PO}_4)_2$ being obtained, according to the experimental conditions; these are also formed by the action of methylamine, ethylamine, aniline, or *p*-toluidine on strontium chloride and disodium hydrogen phosphate. Ammonium magnesium phosphate appears to be the only compound of this class capable of existence.

N. L.

Radioactive Barium and Polonium. By FRITZ GIESEL (*Ber.*, 1900, 33, 1665—1668. Compare von Lengyel, this vol., ii, 402; Curie, this vol., ii, 82).—When concentrated uranium nitrate solution is mixed with a little sulphuric acid, then with a solution of a barium salt, care being taken that sufficient barium salt is not added to cause a precipitate, and finally diluted with water, a strongly radio-active precipitate of barium sulphate is obtained. When this sulphate is converted into a soluble barium salt, and this is then treated with ammonium hydroxide, a small amount of precipitate is obtained which is even more strongly radio-active than the original sulphate; but when the barium is subsequently precipitated as carbonate, it has completely lost its activity. The radio-activity is probably due to small quantities of radium, or more probably of actinium.

Polonium preparations obtained from lead chloride from uranium residues have proved to consist of bismuth hydroxide, which, either in this form or as oxychloride, exhibits strong activity. J. J. S.

Bronzes from Ephesus. By KONRAD NATTERER (*Monatsh.*, 1900, 21, 256—262).—A bronze plate (I) and a bronze statue (II) from Ephesus had the following composition:

I. Tin, 8.67; lead, 12.86; zinc, 0.025; copper, 78.77.

II. Tin, 6.09; lead, 4.87; copper, 89.04.

R. L. J.

Lead and Copper Polysulphides. By F. BODROUX (*Compt. rend.*, 1900, 130, 1397—1398).—When a solution of calcium polysulphide is added to an excess of a dilute solution of lead nitrate cooled at 0° and the precipitate is washed with water, alcohol, and, finally, carbon

disulphide, a purple-red polysulphide, PbS_x , is obtained which decomposes rapidly above 10° into the monosulphide and sulphur.

Cupric acetate under similar conditions yields a brown-red sulphide, Cu_2S_x , which is fairly stable at the ordinary temperature, but gradually decomposes into the monosulphide and sulphur. Both polysulphides are insoluble in alkali sulphides.

O. H. B.

Mercury Chlorosulphide. By F. BODROUX (*Compt. rend.*, 1900, 130, 1398—1399).—When a solution of calcium polysulphide is added to an excess of a cold, saturated solution of mercuric chloride, a chlorosulphide, $\text{Hg}_2\text{S}_x\text{HgCl}_2$, is obtained as a yellow solid, very stable at the ordinary temperature, but altering superficially when exposed to light. It is insoluble in alkali sulphides, but is blackened and decomposed by alkali hydroxides. When heated, it yields sublimates of sulphur and mercuric chloride; it is completely decomposed by concentrated sodium hypobromite solution, but is not affected by fuming nitric acid at the ordinary temperature.

C. H. B.

Action of Water on Mercurous Sulphate. By A. GOUV (*Compt. rend.*, 1900, 130, 1399—1402).—Mercurous sulphate is decomposed by water with formation of a yellow basic sulphate, $\text{Hg}_2\text{O}, \text{Hg}_2\text{SO}_4 + \text{H}_2\text{O}$, which resembles basic mercuric sulphate, but has a marked greenish tinge. Equilibrium is established when the water contains 0.410 gram of mercury and 0.164 gram of sulphuric acid per litre. Water which contains 0.08 gram of sulphuric acid per litre does not convert the normal into the basic salt, and a higher proportion of acid converts the basic salt into the normal. When treated with dilute sulphuric acid, the yellow basic salt becomes white and is thus readily distinguished from basic mercuric sulphate.

Saturated solutions of zinc or cadmium sulphate decompose mercurous sulphate much less readily than water does, but they dissolve more of the unchanged salt.

C. H. B.

Unknown Earths contained in Crude Samarium Oxide. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1469—1472. Compare Abstr., 1896, ii, 475).—The author has previously designated by the symbol Σ an unknown element contained in crude samarium oxide and having an atomic weight intermediate between that of samarium and gadolinium. On fractionating the crude samarium oxide by the aid of the double magnesium nitrate method (this vol., ii, 347), a product is obtained containing the unknown element in a highly concentrated form. Certain lines in the spectrum of the element become greatly enhanced as a result of this fractionation, and amongst these are three blue rays considered by Lecoq de Boisbaudran to be characteristic of the hypothetical element Z_e (Abstr., 1893, ii, 323). It therefore seems highly probable that the two elements Σ and Z_e are identical, and the symbol $\Sigma-Z_e$ is proposed for this constituent of crude samarium oxide. The oxide and salts containing the highest percentage of the new element have a pale rose colour and exhibit characteristic absorption, spark, and reversal spectra; the atomic weight obtained by the synthesis of the sulphate is approximately 151.

The paper contains a detailed description of the spectra which is not suitable for abstraction. G. T. M.

Some Properties of Aluminium : Preparation of Hydrogen Phosphide. By CAMILLE MATIGNON (*Compt. rend.*, 1900, 130, 1391—1394).—Aluminium powder freed from grease burns completely in air if strongly heated at one point, the oxide formed being mixed with a small quantity of nitride. If the powdered metal which has begun to burn in air is lowered into a vessel filled with steam, it continues to burn brilliantly, and the liberated hydrogen burns at the mouth of the vessel. Similarly, aluminium powder will burn in carbon monoxide, carbon dioxide, nitric and nitrous oxides, and nitric peroxide, sulphur dioxide, carbon disulphide, the halogens and halogen hydracids, and the vapours of arsenic, antimony, phosphorus, and sulphur chlorides, and also in the vapour of formic acid in the same manner as in steam. With phosphorus, arsenic, antimony, sulphur, and selenium, results were obtained identical with those described by Fonzen-Diacon (this vol., ii, 405).

The phosphide obtained by the action of red phosphorus on the aluminium powder can be used for the preparation of pure hydrogen phosphide, by placing it together with water in a hydrogen apparatus and adding a very small quantity of dilute sulphuric acid. If hydrochloric acid is used, some hydrogen may be liberated. C. H. B.

Composition of Bottle Glasses. By CHR. DRALLE (*Chem. Zeit.*, 1900, 24, 323—328. Compare Zulkowski, *Chem. Ind.*, 1899, 22, 280; 1900, 23, 108).—A number of analyses of modern glasses have been made in order to see whether Zulkowski's conclusions hold good, as these were based on old analyses. The author does not agree with Zulkowski that the whole of the iron and manganese oxides necessarily act as acids; in some cases, as the result of reduction processes, they act as bases. According to Zulkowski, the "saturation coefficient" (that is, equivalents of base/equivalents of acid) of a good non-soluble glass should be 0.333. According to the author, the coefficient may lie between 0.333 and 0.5.

Again, according to Zulkowski, only one alkaline earth may be present in a good glass, but the author finds that the presence of magnesium in addition to calcium does not lower the quality of the glass. J. J. S.

[Preparation of] Permanganic Acid by Electrolysis. By HARMON N. MORSE and J. C. OLSEN (*Amer. Chem. J.*, 1900, 23, 431—443).—A method of preparation of a solution of pure permanganic acid by the electrolysis of its potassium salt is described in detail. Determinations of the conductivity of permanganic acid produced by the electrolysis of the silver salt gave results agreeing closely with those obtained by Lovén (*Abstr.*, 1895, ii, 451), but differing from those of Franke (*Abstr.*, 1895, ii, 252). E. G.

Crystalline Form of the Nickel Sulphate Compound of Hydroxylamine. By RUDOLF UHLENHUTH (*Annalen*, 1900, 311, 127—128).—The compound $\text{NiSO}_4 \cdot 6\text{NH}_2 \cdot \text{OH}$, first described by the

author (Abstr., 1899, ii, 661), belongs to the triclinic system; measurements and a figure are given in the paper. M. O. F.

Silicovanadiomolybdates. I. By CARL FRIEDHEIM and C. CASTENDYCK (*Ber.*, 1900, 33, 1611—1629).—On mixing ammonium vanadate and ammonium silicomolybdate into a paste with water, interaction occurs, and a clear red solution is obtained, the intensity of the colour being greatest when the molecular ratio $(\text{NH}_4)_2\text{O}$, V_2O_5 : $2(\text{NH}_4)_2\text{O}$, SiO_2 , 12MoO_3 , $8\text{H}_2\text{O}$ is 2:1; from a solution prepared in this way, an *ammonium silicovanadiomolybdate*, $3(\text{NH}_4)_2\text{O}$, SiO_2 , V_2O_5 , 11MoO_3 , $27\text{H}_2\text{O}$, separates in lustrous, red, well-formed crystals, often 2 cm. in length. These crystals are easily soluble in water, and during their formation become contaminated by sparingly soluble ammonium vanadiomolybdates of varying composition, the latter being separated mechanically. The composition of these ammonium vanadiomolybdates, according to the order of their separation, is as follows: (1) $2(\text{NH}_4)_2\text{O}$, $2\text{V}_2\text{O}_5$, 5MoO_3 , $8\text{H}_2\text{O}$, yellow; (2) $(\text{NH}_4)_2\text{O}$, V_2O_5 , 2MoO_3 , $4\text{H}_2\text{O}$, yellowish-green; (3) $2(\text{NH}_4)_2\text{O}$, $3\text{V}_2\text{O}_5$, 4MoO_3 , $11\text{H}_2\text{O}$, bright brown; (4) $(\text{NH}_4)_2\text{O}$, $2\text{V}_2\text{O}_5$, 2MoO_3 , $8\text{H}_2\text{O}$, reddish-brown; (5) $4(\text{NH}_4)_2\text{O}$, $12\text{V}_2\text{O}_5$, 5MoO_3 , $24\text{H}_2\text{O}$, brownish-red. The first three of these are microcrystalline, whilst the two last form felted needles.

On recrystallising the foregoing ammonium silicovanadiomolybdate from water, either hot or cold, decomposition occurs, and a series of new compounds, (1) $3(\text{NH}_4)_2\text{O}$, SiO_2 , V_2O_5 , 9MoO_3 , $20\text{H}_2\text{O}$; (2) $3(\text{NH}_4)_2\text{O}$, SiO_2 , V_2O_5 , 10MoO_3 , $21\text{H}_2\text{O}$; (3) $3(\text{NH}_4)_2\text{O}$, SiO_2 , V_2O_5 , 15MoO_3 , $24\text{H}_2\text{O}$, is obtained; these differ little from the parent substance and from one another in colour and crystalline form, but are differentiated by the behaviour of their saturated solutions with silver, lead, and mercurous nitrates. The following table gives their principal physical properties:

Ammonium silicovanadiomolybdate, $(\text{NH}_4)_2\text{O}:\text{SiO}_2:\text{V}_2\text{O}_5:\text{MoO}_3$	Sp. gr. of solid at 18°.	Sp. gr. of saturated sol. at 18°.	Solubility in grams per c.c.
3:1:1: 9+20H ₂ O	2·8020	1·21322	0·32016
3:1:1: 10+21H ₂ O	2·8044	1·25275	0·35026
3:1:1: 11+27H ₂ O	2·8074	1·29266	0·38086
3:1:1: 15+24H ₂ O	2·8162	1·43761	0·48997

It is noteworthy that the addition of each mol. of molybdenum trioxide causes a regular increase of approximately 0·00237 unit in the sp. gr. of the solid salt; 0·037 unit for the sp. gr. of the saturated solution, and 0·030 unit for the solubility. The salts containing 9MoO_3 and 15MoO_3 can be recrystallised unchanged from water, but that containing 10MoO_3 yields a mixture of the other three salts.

On adding potassium chloride to cold saturated solutions of these ammonium salts, crystalline compounds are precipitated which owe their origin to the replacement of $2\text{K}_2\text{O}$ for $2(\text{NH}_4)_2\text{O}$ in the parent substances; the following table gives their physical properties:

Composition.	Sp. gr. of solid.	Sp. gr. of sat. sol. at 18°.	Solubility in grams per c.c.
$(\text{NH}_4)_2\text{O}, 2\text{K}_2\text{O}, \text{SiO}_2, \text{V}_2\text{O}_5, \left. \begin{array}{l} 9\text{MoO}_3, 20\text{H}_2\text{O} \end{array} \right\}$	2.8648	1.17031	0.24021
$(\text{NH}_4)_2\text{O}, 2\text{K}_2\text{O}, \text{SiO}_2, \text{V}_2\text{O}_5, \left. \begin{array}{l} 10\text{MoO}_3, 21\text{H}_2\text{O} \end{array} \right\}$	2.8682	1.19184	0.25914
$(\text{NH}_4)_2\text{O}, 2\text{K}_2\text{O}, \text{SiO}_2, \text{V}_2\text{O}_5, \left. \begin{array}{l} 11\text{MoO}_3, 12\text{H}_2\text{O} \end{array} \right\}$	2.8704	1.21378	0.27914
$(\text{NH}_4)_2\text{O}, 2\text{K}_2\text{O}, \text{SiO}_2, \text{V}_2\text{O}_5, \left. \begin{array}{l} 15\text{MoO}_3, 14\text{H}_2\text{O} \end{array} \right\}$	2.8803	—	—

Similar laws to those obtaining in the case of the original ammonium compounds regulate the change of sp. gr. and solubility of these salts; moreover, the replacement of 4K for 4NH₄ in the original salts increases the sp. gr. in each case by a constant amount equal to 0.0634 unit. On the other hand, the difference between the sp. gr. of saturated solutions of the corresponding ammonium and potassium salts increases by approximately 0.02 unit for each addition of 1MoO₃, whilst a similar increase of 0.01 unit is observed in the solubility. W. A. D.

Preparation of some Uranium Oxides. By JULES ALOY (*Bull. Soc. Chim.*, 1900, [iii], 23, 368—370).—Uranium oxide, UO₂, is obtained in the form of microscopic, black crystals by heating crystallised uranic hydroxide in a current of hydrogen. When thus prepared, it is not pyrophoric, and is only slowly converted into the green oxide by heating to redness. The violet hydrate of uranosouranic oxide, U₃O₈, which Ebelmen prepared by exposing to sunlight a solution of uranium oxalate, is more readily obtained, in a similar manner, from an alcoholic solution of the acetate, or from a mixture of the aqueous solution of the acetate with ether; it could not be obtained crystalline. The violet hydrate is readily oxidised to uranic hydroxide by exposure to air, and when boiled with water it yields orthorhombic crystals of the composition UO₃·H₂O, which are stable in dry air at 100°. A crystallographic study of these crystals has been made by Bertrand. N. L.

Compounds of Uranic Acid with Sulphurous Acid. By VOLKMAR KOHLSCHÜTTER (*Annalen*, 1900, 311, 1—25).—The simplest compound of uranium trioxide with sulphur dioxide was first obtained by Girard (*Compt. rend.*, 1852, 34, 22) from the action of aqueous sulphurous acid on uranic acid, and is also produced when sulphur dioxide is passed into solutions of uranyl acetate and uranyl nitrate. It is a pale green, crystalline substance, forming minute, slender needles which exhibit double refraction. The composition is expressed by the formula UO₃·SO₂·4H₂O, and when exposed to a temperature of 105° during an hour, the substance loses 3½H₂O.

The compounds, 2UO₃·3SO₂·R₂O, prepared by dissolving the foregoing substance in much sulphurous acid, and adding an alkali hydrogen sulphite to the solution heated on the water-bath, are identical with compounds obtained by Scheller (*Annalen*, 1867, 144, 238), who ascribed to them the erroneous formula UO₂·OR·SO₂H; the potassium, ammonium, and sodium derivatives of this substance are described.

When uranyl sulphite, $\text{UO}_3 \cdot \text{SO}_3 \cdot 4\text{H}_2\text{O}$, is heated on the water-bath with aqueous sulphurous acid in amount insufficient to dissolve it, large, golden-yellow prisms separate; this compound has the empirical formula, $\text{UO}_3 \cdot \text{SO}_3 \cdot 2\frac{1}{2}\text{H}_2\text{O}$, and loses $2\frac{1}{2}\text{H}_2\text{O}$ when heated at 105° .

The compounds, $4\text{UO}_3 \cdot 5\text{SO}_3 \cdot \text{R}_2\text{O} + x\text{H}_2\text{O}$, is prepared by adding an alkali hydrogen sulphite to uranyl nitrate, filtering the amorphous precipitate, and heating it on the water-bath with aqueous sulphurous acid in quantity insufficient for dissolution; the *potassium*, *ammonium*, and *sodium* derivatives of this substance are described.

The compounds, $3\text{UO}_3 \cdot 2\text{SO}_3 \cdot \text{R}_2\text{O}$, produced by the action of water on the foregoing substances, are orange-yellow, crystalline salts; the *potassium*, *ammonium*, and *sodium* derivatives have been prepared.

The compounds, $\text{UO}_3 \cdot 2\text{SO}_3 \cdot \text{R}_2\text{O}$, obtained by passing sulphur dioxide through uranyl nitrate to which excess of alkali hydroxide has been added, separate from the clear, dark yellow liquid in crystalline crusts; the *ammonium* and *potassium* derivatives have been prepared.

Constitutional formulæ for these compounds are suggested by the author.

M. O. F.

Mode of Decomposition of Certain Metallic Perchlorides.

By WILLIAM OESCHNER DE CONINCK (*Compt. rend.*, 1900, 130, 1551—1552).—Auric, platinic, and ferric chlorides are decomposed when their aqueous solutions are filtered through animal charcoal, the metals being completely retained by the filter whilst the acid radicle remains in the filtrate. Similar results were obtained with saw-dust, brick-dust, and coarse or fine grained coke-dust; fine sand, on the other hand, has no action on the perchlorides. This mode of decomposition does not obtain with ferrous chloride, and its nickel, cobalt, manganese, zinc, copper, and magnesium analogues; stannous chloride in dilute hydrochloric acid undergoes oxidation and the oxychloride produced is completely absorbed by the animal charcoal. G. T. M.

Platinum Compounds of Hydroxylamine. By RUDOLF UHLENHUTH (*Annalen*, 1900, 311, 120—126).—The *platinum base*, $\text{Pt}(\text{NH}_2 \cdot \text{OH})_4(\text{OH})_2$, prepared by treating hydroxylamine (12 mols.) with hydroplatinichloric acid (1 mol.) in dilute aqueous solution, boiling the liquid till colourless, and allowing it to cool slowly, separates in slender, snow-white needles, insoluble in water, alcohol, or ether, but readily soluble in dilute mineral acids, acetic acid, or formic acid. Cold dilute nitric acid dissolves it, and when heated, decomposes it completely. When heated at 173° , the dry base explodes and becomes ignited. The *sulphate*, $\text{Pt}(\text{NH}_2 \cdot \text{OH})_4\text{SO}_4$, forms large, triclinic crystals containing $1\text{H}_2\text{O}$. The *hydrochloride*, $\text{Pt}(\text{NH}_2 \cdot \text{OH})_4\text{Cl}_2$, crystallises in flat needles; the action of dilute hydrochloric acid on the base also gives rise to the yellow *salt*, $\text{Pt}(\text{NH}_2 \cdot \text{OH})_2\text{Cl}$, which forms long, golden-yellow needles, and the blue *salt*, $\text{Pt}(\text{NH}_2 \cdot \text{OH})_2\text{Cl}_2$, which crystallises in blue needles. The *nitrate* forms lustrous, colourless needles.

M. O. F.

Mineralogical Chemistry.

Roumanian Petroleums. By LAZAR EDELEANU and G. A. FILITI (*Bull. Soc. Chim.*, 1900, [iii], 23, 382—403).—The first part of this preliminary paper deals with the chemical composition of Roumanian petroleums. These consist principally of carbon and hydrogen, but small quantities of oxygen are often found, especially in the denser varieties from Matita and Sarata, owing to the presence of compounds of an acid character which are extracted from the oil by alkalis. In some specimens, traces of nitrogen and sulphur are found, the latter possibly in the form of compounds analogous to thiophen. A sample of petroleum from Berka (Buzen), having a sp. gr. 0.824 at 15°, was specially examined with the object of ascertaining the nature and amount of benzene hydrocarbons contained therein. From the results obtained by fractionally distilling the oil, treating the separate fractions with nitric acid, and isolating the nitro-derivatives thus produced, the presence of considerable quantities of benzene, toluene, *m*-xylene, mesitylene, and probably higher homologues, was proved. Nearly all the Roumanian petroleums examined were found to contain hydrocarbons of the benzene series, some only in very minute quantities, as with the oils from Casin and Recea, and others in much larger proportions, as was the case with oils from Campeni-Parjol, Colibasi, &c.

In the second part of the paper the physical and technical properties are dealt with, and the results obtained from 36 specimens of petroleum from the provinces of Dambovita, Buzeu, Prahova, and Bacau, are recorded in five tables. The colour of the oils varied from clear yellow to opaque brown or black, and all exhibited a greenish fluorescence. The sp. gr. at 15° ranged from 0.7833 to 0.9050, the boiling point from 25° to 62°, and the viscosity at 20° (water at 20° = 1) from 1.04 to 4.88, but usually lay between 2.00 and 2.80. The odour was in most cases feebly ethereal and agreeable, but some specimens had a strong alliaceous odour and others an odour of hydrogen sulphide. The flash point, as determined with the Abel-Pensky apparatus, was almost always below 0°. The behaviour of the oils on distillation was carefully studied and the characters of the various products examined. The best light oils are yielded by petroleums from Campeni-Parjol, Casin, Poiana, Plopeni, and Predeal Berka, whilst the Gura-Ocniti, Tintea, and Sarata petroleums are richest in heavy, high boiling oils.

N. L.

Minerals from the Bogoslowsk District, Urals. By EUGRAPH S. VON FEDOROFF and W. W. NIKITIN (*Ann. Geol. Min. Russie*, 1899, 3, 79—91, 91—103).—A description is given of several mineral species from the Bogoslowsk mining district, where ores of copper and iron are won. Analyses are given of the following.

Quartzine in the form of microscopic spherulites, with a little bright green chloritic mineral in the interspaces, occurs as blocks embedded in diabase on the river Kakwa. Analysis gave:

SiO ₂	Al ₂ O ₃ , FeO ₃	CaO.	MgO.	H ₂ O.
90.83	5.25	0.33	0.29	2.1

Garnet from augite-garnet rocks gave I for the resin-brown, and II for the pale greenish crystals.

	SiO ₂	Fe ₂ O ₃	Al ₂ O ₃	Mn ₂ O ₃	FeO.	CaO.
I.	34.98	23.77	3.32	1.22	3.33	34.06
II.	38.22	25.62	2.11	0.58	1.96	31.80

Datolite occurring as a crust on the walls of a diabase dyke gave, on analysis by Januskewitsch :

SiO ₂	Al ₂ O ₃ , Fe ₂ O ₃	CaO.	MgO.	H ₂ O, CO ₂	B ₂ O ₃
36.77	0.31	33.78	1.5	8.4	[19.24]

Muschetowite is the name given to a pseudomorph of magnetite after hæmatite; it has the platy structure of hæmatite, but a black streak, and is strongly magnetic with polarity. The analysis (Fe₂O₃, 75.35; FeO, 19.88; H₂O, 0.31; insol., 4.4) shows that the change from hæmatite to magnetite has not been quite complete.

Marsjatskite is the name given to a manganglauconite which forms the bulk of a Tertiary sandstone in the Marsjat forest; the microscopic grains are amorphous, and have a very pale green tint. A partial analysis of the rock, which also contains grains of quartz and other minerals, gave: SiO₂, 20.94; Fe₂O₃, 8.78; Mn, 25.66 per cent. On exposure to air, the material is easily altered, giving rise to workable deposits of manganese ores containing 35—40 (max. 50) per cent. of manganese.

L. J. S.

Jadeite from Piedmont. By GIUSEPPE PIOLTI (*Jahrb. Min.*, 1900, i, Ref. 341; from *Atti Accad. Sci. Torino*, 1899, 34, 600—608. Compare Abstr., 1898, ii, 525).—A green pebble found in a moraine at the entrance of the Susa Valley, near Rivoli, has the characters of jadeite. Sp. gr. 3.407. The results of the analysis differ considerably from those required by the jadeite formula, NaAl(SiO₃)₂, but agree with those of an analysis by Damour of Asiatic jadeite :

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	Cr ₂ O ₃	CaO.	MgO.	Na ₂ O.	Loss on ignition.	Total.
55.11	9.66	7.55	trace	12.04	7.33	7.84	0.33	99.86

Only one pebble was found, and the original locality of the material is not known. This occurrence is discussed in connection with the neolithic jade implements of Central Europe.

L. J. S.

Minerals from the Radauthal, Harz. By JOHANNES FROMME (*Jahresber. Ver. Naturwiss. Braunschweig*, 1900, 12, 31—42).—Descriptions are given of several minerals from the gabbro and the pegmatite of the Radauthal near Harzburg in the Harz.

Cavities between the gabbro and pegmatite are filled with calcite and a chloritic mineral; the latter, which is referred to chalcodite, occurs as scaly to granular masses of a greyish-green colour; sp. gr. 2.44. It is easily decomposed by hydrochloric or sulphuric acid, with separation of flocculent silica. The following is the mean of two analyses made on material separated from calcite by the action of acetic acid. Direct determinations of the iron on unprepared material gave Fe₂O₃, 4.82; and FeO, 28.20 per cent.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	CaO	MgO	H ₂ O	K ₂ O, Na ₂ O	Total
47.15	4.49	9.00	24.60	1.49	0.50	3.71	8.70	traces	99.64

L. J. S.

Weathering of Diabase in Virginia. By THOMAS L. WATSON (*Amer. Geologist*, 1899, 24, 355—369. Compare Abstr., 1898, ii, 612).—Analyses are given of the fresh and altered rock from a dyke adjacent to the one previously described, and similar results are obtained.

L. J. S.

Meteorite from Ergheo, Somaliland. By ETTORE ARTINI and GILBERTO MELZI (*Jahrb. Min.*, 1900, i, Ref. 357—360; *Soc. d'Esplorazione Commerciale in Africa*, Milan, 1898, 12 pp., and *Rend. R. Ist. Lombardo*, 1898, [ii], 31, 983—994).—This stone fell in July, 1889, at Ergheo, near Brava, in the Somali peninsula; it weighs 20,375 grams, but was originally somewhat larger. Sp. gr. 3.31. Chondrules of olivine or of enstatite or of both are set in a crystalline ground mass of olivine and enstatite; troilite, metallic nickel-iron, magnetite, glass, maskelynite, and possibly feldspar are also present. Analysis by G. Boeris gave the following results:

Metallic Fe.	Ni + Co.	FeS.	Sol. in HCl.	Insol. in HCl.	Total.
0.57	0.17	9.48	56.50	32.73	99.45

	SiO ₂	FeO.	Al ₂ O ₃	CaO.	MgO.	Na ₂ O, K ₂ O.	Total.
Sol. in HCl	23.69	12.95	0.56	0.71	18.59	—	56.50
Insol. in HCl	57.62	12.79	5.11	1.13	23.06	0.41	100.12

L. J. S.

Meteoric Iron from Morradal, Norway. By EMIL W. COHEN (*Jahrb. Min.*, 1900, i, Ref. 354; *Videnskabs-Selskabets Skrifter, Christiania*, 1898, Class I, No. 7, 12 pp.).—This iron was found at Morradal near Grjotli, between Skiaker and Stryn; it weighs 2750 grams. It belongs, with the irons from Smithland and Babb's Mill, to the group of ataxites rich in nickel. Analysis by O. Sjöström gave:

Fe.	Ni.	Co.	Cu.	Cr.	P.	S.	Sp. gr.
79.67	18.77	1.18	0.06	0.06	0.18	0.27	7.8543

This corresponds with the following mineralogical composition: nickel-iron, 98.12; schreibersite, 1.17; troilite, 0.55; daubréelite, 0.16.

L. J. S.

Mineral Water from the Cold or "Park" Spring at Evaulles-Bains (Creuse). By EDMOND BONJEAN (*Bull. Soc. Chim.*, 1900, [iii], 23, 405—407).—This is a saline, alkaline water containing 1.492 grams of solid matter per litre and having a temperature of 8°; minute quantities of lithium, manganese, arsenic, and fluorine were detected.

N. L.

Mineral Water from the Brault No. 3 Spring at Sail-sous-Couzan (Loire). By EDMOND BONJEAN (*Bull. Soc. Chim.*, 1900, [iii], 23, 408—409).—The water contains 2.1305 grams per litre of solid

matter, consisting chiefly of sodium, potassium, calcium, and magnesium carbonates; it is remarkable for the large quantity of free carbon dioxide it contains, namely, 1438 c.c. per litre. N. L.

Waters of Salsomaggiore. By RAFFAELE NASINI and FRANCESCO ANDELLINI (*Gazzetta*, 1900, 30, i, 305—333).—The mineral constituents of these waters consist mainly of sodium and calcium chlorides, small quantities of a large number of other salts being also present. They are very rich in bromine and iodine, and contain a larger proportion of strontium and lithium than any other known natural water; the quantities of these constituents in grams per litre of the water from the spring "delle Saline" are: Br, 0.26411; I, 0.06050; Sr, 0.42780; Li, 0.12152. The dissolved gases, present to the extent of 20.64 c.c. per litre, consist principally of methane, ethane, and carbon dioxide, with smaller quantities of heavy hydrocarbons, nitrogen and oxygen (compare this vol., ii, 415). T. H. P.

Physiological Chemistry.

Action of Morphine on Respiration. By HUGO WINTERNITZ (*Pflüger's Archiv*, 1900, 80, 344—350. Compare this vol., ii, 221).—Polemical. The work of, and conclusions drawn by, Impens (this vol., ii, 28) are criticised. W. D. H.

Rôle of Purine Substances in Human Metabolism. By RICHARD BURIAN and HEINRICH SCHUR (*Pflüger's Archiv*, 1900, 80, 241—343).—Every healthy adult excretes a certain characteristic amount of alloxuric or purine substances, which is independent of his diet. This is the result of tissue metabolism, and may be termed 'endogenous urinary purine.' Its amount may be directly estimated by examining the urine after a diet of substances which are practically free from purine compounds (milk, white bread, potatoes, rice, green vegetables, eggs, and cheese). Examination of the urine during hunger does not give trustworthy results; but on ordinary diet, the amount of urinary purine is increased by a part of the 'nutrition purine,' and this may be termed 'exogenous urinary purine.' The nutrition purine does not pass wholly into the urine; a certain fraction remains in the organism, the purine double ring being broken down. The amount of the remainder (exogenous urinary purine) differs for different forms of food, and is but little affected by the individuality of the subject of the experiment. The following table gives some of the figures quoted:

Diet.	Total percentage of purine substances in diet.	Percentage of exogenous urinary purine.
Beef and veal	0.06	0.03
Coffee	0.2	0.075
Calf's liver	0.12	0.06
Calf's spleen.....	0.16	0.08
Calf's thymus	0.4	0.1

By subtracting the exogenous from the total urinary purine, the endogenous urinary purine is obtained, and the results agree closely with the numbers obtained by direct estimation; it varies in the majority of people from 0.1 to 0.2 gram daily; but higher and lower values were obtained.

W. D. H.

Use of Horse-flesh as Food. By EDUARD PFLÜGER (*Pflüger's Archiv*, 1900, 80, 111—138).—Horse-flesh by itself causes digestive disturbances, especially diarrhoea. This is partly, but not wholly, explained by the poorness of the tissue in fat. There is, however, besides, some toxic material in the flesh, which is removed by extraction with hot water or alcohol; it is not soluble in ether. It was not further identified. Horse-flesh, before it is eaten, should, therefore, be extracted with hot water, and mixed with either mutton or beef fat; these solid fats are better than that of the pig. The modern view of fat absorption, namely, that hydrolytic decomposition of the fat is necessary, is supported.

W. D. H.

NOTE BY ABTRACTOR.—Pflüger's experiments were made on dogs, but recent experiences during the siege of Kimberley have led to the same result. The necessity of mixing the horse-flesh with beef suet was well known to the medical men in South Africa.—W. D. H.

Sugar as Food. By FRIEDRICH STROHMER (*Bied. Centr.*, 1900, 29, 172—174; from *Oest.-Ung. Zeit. Zuckerind. Landw.*, 1899, Heft 3).—The importance of sugar as food is indicated by the fact that in human milk lactose is the most prominent constituent, and the results of Soxhlet and Biedert's experiments showed that sucrose is at any rate not inferior to lactose.

According to Schumburg, even small amounts of sugar (30 grams) will renew the power of muscles, tired by work, in half or three-quarters of an hour. Sugar is accordingly specially suited for the production of muscular force, this property being increased by the action of sugar on the nervous system in overcoming the feelings of fatigue.

Excessive consumption of sugar is to be avoided, as digestion would be interfered with; no injury to the teeth will result, as is frequently supposed. When properly employed, sugar is of great value as food, especially after bodily exertion.

N. H. J. M.

Mineral Statics of the Human Foetus during the last Five Months of Intrauterine Life. By LOUIS HUGOUNEQ (*Compt. rend.*, 1900, 130, 1422—1424).—Sodium chloride is assimilated by the human foetus chiefly at the beginning and during the middle period of gestation, but the assimilation of this compound falls off markedly towards the end of the period. During the second half of gestation, the assimilation of phosphoric acid is very regular, but increases somewhat towards the end, whilst the assimilation of calcium increases very markedly towards the end and becomes relatively greater than that of phosphoric acid, the excess being found in the ash in the form of calcium carbonate. With these exceptions, the assimilation of inorganic constituents is almost constant during the last five months, although there is a marked increase in the total weight towards the

end. The cellule of the embryo at four months has practically the same requirements, as regards inorganic food, as the cellule at the end of gestation. The maximum rates of assimilation of sodium chloride on the one hand, and of phosphoric acid and calcium on the other, correspond respectively with the genesis of the red corpuscles and of the osseous system.

C. H. B.

Rôle of Iron in Blood Formation. By A. HOFMANN (*Virchow's Archiv*, 1900, 160, 235—306).—Iron in various forms of organic and inorganic combination is absorbed in the duodenum, and is carried in union with proteid in the 'transport' cells of the blood to the spleen, liver, and especially to the bone marrow. The principal use of the metal is to act as a stimulus to the red marrow. It causes an increase in the growth and activity of this tissue, and so leads to an increased formation of the blood discs. In chlorosis, the bone marrow becomes comparatively inactive.

W. D. H.

Action of Oxygen on the Excised Mammalian Heart. By GÜNTHER STRECKER (*Pflüger's Archiv*, 1900, 80, 161—175).—A new apparatus is described and figured for artificially feeding an excised mammalian heart. The most important result of the experiments recorded is the importance of oxygen in the nutritive fluid. Blood containing carboxyhæmoglobin soon brings the heart to a standstill, not because carbon monoxide is a poison to the organ, for it still remains excitable, but because it contains no free or readily dissociable oxygen. Fresh arterial blood will set such a heart beating again. This need of oxygen for cardiac activity has been previously insisted on by Yeo (*J. Physiol.*, 1885, 6, 535), and more recently in connection with the mammalian heart by Porter (*Amer. J. Physiol.*, 1898, 1, 511).

W. D. H.

Value of Calcium and Potassium Ions in Cardiac Activity. By JACQUES LOEB (*Pflüger's Archiv*, 1900, 80, 229—232).—The conclusion is drawn that calcium and potassium ions are unnecessary for the maintenance of cardiac and other rhythmical actions, but their usefulness is indirect in neutralising the poisonous action of the sodium chloride which is present in the blood and in sea water.

W. D. H.

Elementary Composition and Heat of Combustion of Human Fat. By FRANCIS GANO BENEDICT and EMIL OSTERBERG (*Amer. J. Physiol.*, 1900, 4, 69—76).—The composition of human fat appears to be remarkably constant; the average of twenty-four determinations gives hydrogen, 11.78, and carbon, 76.08 per cent. The heat of combustion averages 9.523 cal. per gram.

W. D. H.

Preparation of Pure Glycogen. By ERNST BENDIX and JULIUS WOHLGEMUTH (*Pflüger's Archiv*, 1900, 80, 238—240).—Glycogen prepared by Pflüger's modification of Külz's method gives the phloroglucinol and orcinol reactions for pentoses. This is due to an admixture with a pentose or pentosan, for after repeated solution in hot water and precipitation by alcohol, the reaction is lost. After treatment of the impure glycogen with hydrochloric acid, and removal

of the greater part of the sugar so formed by fermentation with yeast, the product yields two osazones, one of which is hexosazone, from the remains of the sugar not decomposed by the yeast; the other, which melts at 153–155°, has all the characters of pentosazone. The source of the pentose is believed to be the nucleo-proteid of the liver; indeed, the glycogen is usually contaminated with nuclein.

W. D. H.

Physiology of the Suprarenal Capsules. By BENJAMIN MOORE and C. O. PURINTON (*Amer. J. Physiol.*, 1900, 4, 51–56, 57–59).—The cause of the death which often supervenes within 24 hours after extirpation of the suprarenals is obscure. In cats, cardiac thrombosis is, however, frequently found. A predisposing condition for the ready occurrence of intravascular clotting is to be found in the enfeeblement of the circulation.

The large relative size of these organs in foetal animals is not found in all animals, as, for example, in the cat. In the human embryo and new-born child, the glands are comparatively large, but their medulla contains neither chromogen nor active physiological principle. In the embryonic ox and goat, both appear to be present.

W. D. H.

Alimentary Oxaluria. By GALILEO PIERALLINI (*Virchow's Archiv*, 1900, 160, 173–185).—The soluble and insoluble salts of oxalic acid, the latter in smaller degree, are absorbed, and pass as calcium oxalate into the urine. Foods containing excess of oxalates cause the excretion to increase. The absorption of such insoluble oxalates as that of calcium can hardly be explained as the result of the action of the dilute acid of the gastric juice, but is attributed to decomposition, brought about by the presence of alkali carbonates in the intestine.

W. D. H.

Action of certain Renal Poisons. By W. LINDEMANN (*Ann. Inst. Pasteur*, 1900, 14, 49–59).—This records the commencement of a research on poisons which affect the kidneys, and aims at the elucidation of the manner in which the toxins in serum, and in such diseases as scarlet fever, bring about renal disorder. The special poison here investigated is vinylamine, and the experiments were performed on mice, rabbits, and dogs, some of which were rapidly killed with fatal doses, and others subjected to chronic poisoning. In immediately fatal cases, the main effects in the kidney are explicable by anæmia. In the more chronic cases, the urine is dilute, highly albuminous, and contains casts and epithelial *débris*; the kidneys show signs of acute nephritis. The interstitial connective tissue is not affected. Certain toxic serums produce somewhat similar results.

W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Fermentation of Cellulose. By V. OMELIANSKY (*Chem. Centr.*, 1900, i, 918—919; from *Arch. Sci. biolog. St. Pétersb.*, 7, 411—434. Compare Abstr., 1898, i, 291).—The morphological properties of *Bacillus fermentationis cellulose* are described in the original paper. Cellulose is attacked by this organism in solutions which contain only mineral salts, the fermentation being effected through a series of changes, by which the specific ferment is gradually purified, and eventually left as a pure culture. The cellulose yields 70 per cent. of fatty acids, acetic acid, and butyric acid, and 30 of gases (carbon dioxide and hydrogen); methane is only formed in the last phases, and is possibly due to the action of another microbe. Hoppe-Seyler's fermentation of cellulose in which carbon dioxide and marsh gas are formed, but no solid or liquid products, is probably effected by a bacillus which has not yet been isolated; this bacillus is probably not the amylobacterium.

E. W. W.

Identity of the Aërogenic Bacillus of Milk with the Pneumobacillus of Friedländer. By LEON GRIMBERT and G. LEGROS (*Compt. rend.*, 1900, 130, 1424—1425).—The aërogenic bacillus of milk and the pneumo-bacillus of Friedländer agree in the following characteristics, and seem to be completely identical; they are immobile, do not liquefy gelatin, and do not produce indole in culture fluids containing peptone, but ferment various carbohydrates, yielding products which vary with the nature of the sugar; and they produce capsules in the blood of animals inoculated with them.

C. H. B.

Action of the Bacillus Anthracis on Carbohydrates. By MDLLE. NAPIAS (*Ann. Inst. Pasteur*, 1900, 14, 232—248).—The anthrax bacillus attacks starchy and saccharine materials, yielding lactic and acetic acids. The latter acid is believed to be formed from the former. In virulent species, proteolytic properties are dominant, and in attenuated specimens amylolytic action is predominant.

W. D. H.

Proteolysis produced by Aspergillus Niger. By G. MALFITANO (*Ann. Inst. Pasteur*, 1900, 14, 60—81).—The secretion of a proteolytic enzyme is constant during the life of *Aspergillus niger*, and is chiefly associated with the death of the cells. It is believed that such agents will not only produce effects on the surrounding medium, for instance, the liquefaction of gelatin, but also in the protoplasm of the cells carry out the work of disassimilation.

W. D. H.

Resolution of a Racemic Compound by means of Moulds. By C. ULPANI and S. CONDELLI (*Gazzetta*, 1900, 30, 1, 382—394).—Results are given of a number of experiments made to determine the conditions best suited for the resolution of a racemic compound into its optically active isomerides by means of moulds. The spores of

Aspergillus niger do not develop in absence of oxygen, but they are not killed, unless indeed by a very long exposure in a vacuum. This mould attacks a racemic compound more energetically in presence of a small quantity of oxygen than when a larger quantity is present, but at the same time less of the optically active isomeride is obtained, since Pfeffer's economic coefficient, that is, the ratio of material consumed to that formed, has a greater value when there is a deficiency in the oxygen employed. The life, and hence also the activity, of moulds are almost entirely inhibited by sunlight, and the rapidity with which a racemic compound is resolved increases as the luminosity decreases, and increases also with the temperature. Experiments with racemic, lactic, and mandelic acids and alanine show that *Penicillium glaucum* flourishes best in solutions of greater concentration and less acidity than is the case with *Sterigmatocystis niger*. The proportion of inorganic salts necessary for the complete development of moulds is very small, the small quantity dissolved from the glass vessel containing the solution being sufficient. On growing *Sterigmatocystis niger* in 5 litres of solution containing 120 grams of crystallised racemic acid and small quantities of ammonium, potassium, and magnesium salts, it was found that in the first period, extending to the end of the 32nd day, *d*-tartaric acid was almost exclusively destroyed; after this, the destruction of the dextro-acid continued, and was completed after a further 33 days, 27 per cent. of the total lævo-acid being also destroyed; during the third period, from the 65th to the 123rd day, the fermentative process became weaker, since, besides the last traces of dextro-acid, only 7 per cent. of the initial quantity of lævo-acid was destroyed. After this, no further appreciable action took place, although the mould was found to be capable of vigorous growth in a suitable medium. From the residual liquid, only potassium hydrogen *l*-tartrate could be separated, and in a solution of this salt, as stated by Pfeffer, no development of *Aspergillus niger* is possible.

T. H. P.

Denitrification. By ALBERT STUTZER and HJALMAR JENSEN (*Bied. Centr.*, 1900, 29, 268—273; from *Centr. Bakt.*, 1897, 622 and 698).—The results of experiments with pure cultures of various denitrifying bacteria on the utilisation of carbon compounds, showed that citric acid alone is sufficient to supply the necessary carbon. Dextrose alone is unsuitable, and in presence of citric acid even somewhat retards growth; it is, however, not altogether useless; there is a connection between the nitrate destroyed and the carbon compounds used up in solutions which contain, besides sugar, citric acid. In such solutions, continued addition of nitrate soon stops denitrification, which is, however, renewed on adding more sugar.

Glycerol and starch (compare Déherain, *Abstr.*, 1899, ii, 511) do not produce fermentation, either separately or together; but a mixture of glycerol and a citrate is suitable. Lactic and butyric acids, but not formic acid, are very good sources of carbon when employed in Giltay and Aberson's solution, in the place of citric acid.

When, instead of pure cultures, garden soil is employed, glycerol is decomposed by putrefaction bacteria, and the products are utilised by

denitrifying bacteria. Similar, and still more decided, results were obtained with straw.

The value of stable manure as nitrogenous manure diminishes as the amount of carbonaceous matter available for denitrifying bacteria increases. When fresh manure is ploughed in late, the yield of the succeeding crop is less than when an equal amount of moderately rotted manure is employed, even when the two lots contain the same amount of available nitrogen. This difference is attributed to the much larger amount of energy at the disposal of the denitrifying bacteria in the fresh manure. The number of bacteria is of less importance. Considerable losses through denitrification will not take place in old, rotted manure; but denitrification does not entirely cease even when humification is far advanced.

The general conclusion is drawn that the value of dung as nitrogenous manure depends very essentially on the carbonaceous matter present; the use of plenty of peat litter in stables is recommended.

N. H. J. M.

Morphology and Biology of Denitrifying Bacteria. By HJALMAR JENSEN (*Bied. Centr.*, 1900, 29, 273—275; from *Centr. Bakt.*, 1898, 4, 401 and 448).—The term denitrifying bacteria is restricted to those which liberate free nitrogen; the bacteria which produce organic nitrogenous compounds, or nitrites and ammonia from nitrates, are not included.

The bacteria are aerobic in absence of nitrate, but utilise the oxygen of nitrate when present. Aëration prevents destruction of nitrates.

The bacteria at present known are: (1) *Bacillus denitrificans*, I., Burri and Stutzer = *Bacterium denitrificans*, Lehm. and Neum.; (2) *Bacillus denitrificans*, II., Burri and Stutzer = *Bacterium Stutzeri*, Lehm. and Neum.; (3) *B. Shirokikhi*, Jensen; (4) *B. denitrificans agilis*, Ampola and Garina; (5) *Vibrio denitrificans*, Sewerin; (6) *Bacillus pyocyaneus*, Sewerin; (7) *B. pyocyaneus*, Lehm. and Neum.

In addition to the above, the author has isolated four others: (8) *Bacterium filifaciens* (from an old cultivation of *B. Stutzeri*); (9) *B. centropunctatum* (from cow-dung and guinea-pig fæces); (10) *B. Harilebii* (from soil from Ellenbach), and (11) *B. nitrovorum* (from horse-dung).

As regards the distribution of denitrifying bacteria, analyses of six samples of air gave negative results; it was, however, found that inoculation may take place through the air. Peat and autumn leaves of *Poa annua* and *Senecio vulgaris* gave negative results. Straw always gave positive results, and out of 17 samples of soil, 5 denitrified. In the soil, the bacteria are derived from the dung applied, and disappear if the soil is left unmanured. Fæces from cows, horses, and sheep frequently contained denitrifying bacteria; in the case of guinea-pigs, mice, pigs, and earth worms, the bacteria were sometimes found. Human fæces and the fæces of lions, dogs, canaries, and geese never contained the bacteria. The bacteria are destroyed in their passage through the human digestive system, and the same occurs with dogs and worms.

N. H. J. M.

Effect of Removing the Flowers on the Assimilation of Nitrogen by Leguminous Plants. By MARCO SOAVE (*Expt. Stat. Record*, 1900, 11, 516; from *Staz. sper. agrar. ital.*, 1899, 32, 499—516).—Comparing the results obtained when the flowers were constantly removed, with those obtained with similar plants which were left with the flowers, it was found that, in the case of *Vicia faba*, there was a decided gain in dry matter and nitrogen when the flowers were cut off. In the case of *Phaseolus multiflorus*, *Pisum sativum*, and *Lupinus albus*, there was a loss of either dry matter or nitrogen, or of both.

N. H. J. M.

Effect of Ferments on the Germination of Old Seed. By A. THOMSON (*Expt. Stat. Record*, 1899, 11, 460; from *Gartenflora*, 45, 344).—Cereal seeds, 20—25 years old, were soaked in diastase or pepsin solutions for 24 hours, washed and germinated. Barley which gave a germination of 4.5 per cent. germinated to the extent of 35 per cent. after treatment with 5 per cent. diastase solution, and 48 per cent. when a 10 per cent. diastase solution was employed; in a similar manner, the germination of oats was raised from 16 to 47 and 54 per cent. respectively. Pepsin (5 per cent. solution) increased the germination of oats to 39 per cent. The germination of maize, peas, and clover rose from 3, 5, and 17 per cent. to 49, 22, and 50 per cent. when treated with 5 per cent. diastase solution.

N. H. J. M.

Relation of the Ash to the Height of Plants. By EDMUND J. MILLS, JOHN IMBIE, and ARCHIBALD GRAY (reprinted from *Proc. Phil. Soc. Glasgow*, 1900, 8 pp.).—The stem of a healthy spruce fir, cut down in December, was cut into 14 sections, each 19 $\frac{3}{4}$ inches long. These were burnt in a specially devised apparatus, described with sketch, and the weight of ash in each section determined; silica and lime were determined in the ashes. The actual weights of wood, ash, and constituents, as well as the percentage results, are given in tables, and the relations between the height of the tree and the weights of wood, ash, silica, and lime are shown in smoothed curves.

As regards silica, it was found that the point $h=3.1$ is a critical point, indicating the theoretical position at which the chemical effect of the unexposed trunk, as a mineral carrier, is at its lowest, owing probably to the sudden demand for ash by the large lowest branches. An upper critical point, $h=13.724$, was also found. This depends on the demand due to the exceptional vitality at the summit.

In the case of lime, the lower critical point is somewhat below that for silica; the higher critical point is of an ideal character, being above the top of the tree.

It is supposed that similar points occur in the branches, and even in the twigs.

N. H. J. M.

Distribution of Ash Constituents in the Section of the Copper Beech. By RICHARD HORNBERGER (*Bied. Centr.*, 1900, 29, 187—190; from *Mündener forstl. Hefte* 1898, 14. Compare *Abstr.*, 1897, ii, 280).—The intermediate portions of the sections of the two copper beeches previously examined (*loc. cit.*), corresponding with the 26th to the 87th and 90th years of growth, were divided into three portions, each

representing about 20 years of growth, for more detailed investigation. The middle portion (45th—65th years) was found to contain the least ash in the dry matter, the least phosphoric acid, and also the least, or, in the case of (B), almost the least, potassium; but it contained the greatest amount of calcium, and the most, or almost the most (in B), manganese.

In the same zone, but on different sides of the tree, there may be differences in the composition of the ash; even then, however, the results still show that potassium and phosphoric acid on the one hand, and calcium and manganese on the other, go together. N. H. J. M.

Composition of Cocoa-nut Ash. By A. BAIN and F. BACHOFEN (*Queensland Agric. Jour.*, 1900, 6, 297).—The different parts of the cocoa-nut weighed as follows: (1) Husk, 2·702; (2) shell, 0·546; (3) kernel, 0·875; and (4) milk, 0·593 lb., and contained (1) 34·44, (2) 84·80, and (3) 47·20 per cent. of dry matter, and 1·63, 0·29, 0·79, and 0·38 per cent. respectively of pure ash. Analyses of the ashes gave the following percentage results:

	K ₂ O.	Na ₂ O.	CaO.	MgO.	Fe ₂ O ₃ , Al ₂ O ₃ .	P ₂ O ₅ .	SO ₃ .	SiO ₂ .	Cl.
Husk ...	30·71	27·58	4·14	2·19	0·54	1·92	3·18	8·22	27·82
Shell ...	45·01	23·65	6·26	1·32	1·39	4·64	5·75	4·64	9·44
Kernel..	54·05	2·65	3·10	1·98	0·59	20·33	8·79	1·31	9·24
Milk....	34·54	13·95	7·43	3·97	trace	5·68	3·94	2·95	35·50

N. H. J. M.

Distribution of Sugar, Acid, and Tannin in Pears. By W. KELHOFFER (*Bied. Centr.*, 1900, 29, 248—251; from *Jahresber. Wädensweil*, 6, 68). The following amounts of sugar (invert), acid (tartaric), and tannin were found in the different parts of the pear:

Skin.			Fruit.			Core.		
Sugar.	Acid.	Tannin.	Sugar.	Acid.	Tannin.	Sugar.	Acid.	Tannin.
7·74	6·20	2·80	8·24	14·83	2·36	7·31	11·71	0·97

Whole Pear.		
Sugar.	Acid.	Tannin.
8·00	12·61	2·05

Similar experiments were obtained with two other varieties of pears, (*Bied. Centr.*, 1899, 28, 68), and it is thought that it may be assumed that all varieties would show the same distribution of the different constituents at the same stage of ripeness. As ripening proceeds, the tannin diminishes more quickly in the inner parts of the pear than in the skin. By the time the pears had become doughy, the inside portions were free from tannin, whilst the skin still contained 1·9 per cent., or 65·8 per cent. of the original amount. The acid diminishes most quickly in the skin.

Analyses of three cross-sections of the pear, representing (1) the calyx, (2) the core, and (3) the stem portions, showed, after the removal of the calyx, &c., that the calyx portion contained the highest percentages of sugar, acid, and tannin. The seed portion contained the least tannin and the stalk portion the least sugar and acid. N. H. J. M.

Composition of the Albumens of the St. Ignatius Bean and Nux Vomica. By ÉMILE BOURQUELOT and J. LAURENT (*Compt. rend.*, 1900, 130, 1411—1413).—The albumen of the St. Ignatius bean when hydrolysed with dilute sulphuric acid yields 27 per cent. of mannose and 31 per cent. of galactose, and the albumen from nux vomica yields 11·3 per cent. of mannose and 41·6 per cent. of galactose. The carbohydrate of both albumens is therefore a mixture of mannan and galactan. Either of them can be used for the preparation of crystallised galactose, and will give a better yield than milk sugar. C. H. B.

Agaricus Campestris. By ALEXANDER ZEGA (*Chem. Zeit.*, 1900, 24, 285—286).—The mean result of various analyses give: Water, 89·22; nitrogen compounds, 5·94; fat, 0·23; nitrogen free material, 2·92; fibre, 0·84; and ash, 0·75 per cent. The ash contained P_2O_5 , 0·188; K_2O , 0·156; sand, 0·056. The finely-divided and air-dried fungus was extracted with alcohol at 45—50°, and in this liquid chlosterol and mannitol have been detected. J. J. S.

Composition of Apios Tuberosa. By CELSO BRIGHETTI (*Chem. Centr.*, 1900, i, 914—915; from *Staz. sperim. agrar. ital.*, 33, 72—75).—Analyses of the various portions of the plant, *Apios tuberosa*, are quoted. E. W. W.

Alinit in the Cultivation of Cereals. By L. MALPEAUX (*Ann. agron.*, 1900, 26, 196—211. Compare Abstr., 1899, ii, 242).—Inoculation with alinit had no effect on wheat grown in sand. When inoculated a second time in conjunction with applications of sugar and extract of straw respectively, the production of wheat was increased. Dung gave a greater increase than was obtained by inoculation, and the yield was further increased by inoculation in conjunction with dung. Alinit had a greater effect in increasing the production of wheat grown in rich soil, and the effect was increased by a second application of alinit, together with sugar. The increase due to inoculation was chiefly in the straw.

Field experiments were made with wheat and barley in soil containing 0·134 per cent. of total nitrogen. In the case of wheat, there was no increased production of grain after inoculation, but the straw was increased by about 300 kilos. In the barley experiment, the alinit plots gave slightly more grain and 410 kilos. more straw per hectare; with an application of sodium nitrate (150 kilos.), the yields of grain and straw were increased by 320 and 610 kilos.

The results showed, therefore, that inoculation with alinit is useless in absence of carbohydrates or a great deal of humus; in rich soil, it was decidedly beneficial, but sodium nitrate gave much the best results. Inoculation can only be of use when conditions favourable to the growth of the microbes exist in the soil; and Dehérain has shown that, under these conditions, fixation of nitrogen can take place in soils without inoculation, which is, as a rule, superfluous. N. H. J. M.

[Composition of] Weak Straw. By J. ALAN MURRAY (*Ann. Rep on Field Expts. Univ. Coll. Wales*, 1899, 79—80).—Analyses were made of two lots of rye straw, (1) manured with phosphates, nitrogen, and potash; (2) with phosphates and nitrogen only. Whilst the more fully manured straw was in every respect normal, that obtained on the

plot which had no potash was too weak to stand, and when dried was so brittle that it could almost be reduced to powder when crushed in the hand. The air-dried straw from the two plots had the following percentage composition :

	Water.	Nitrogenous matter.	Oil.	Soluble carbohydrates.	Crude fibre.	Ash.
1.	10.29	6.11	3.35	46.01	30.64	3.60
2.	12.46	10.06	—	45.14	27.80	4.54

Both samples were cut when somewhat immature, but having been cut on the same day and grown from the same seed sown at the same time, the results are comparable.

When distilled with hydrochloric acid, the two samples yielded (1) 9.26 and (2) 10.95 per cent. of furfuraldehyde.

The results indicate that the weakness of the straw (2) cannot be due to defective lignification, and that it is probably connected with the deficient production of oil which was practically absent in the weak straw.

N. H. J. M.

Influence of Nitric and Ammoniacal Nitrogen on the Development of Maize. By PIERRE MAZÉ (*Ann. Inst. Pasteur.*, 1900, 14, 26—45. Compare *Abstr.*, 1899, ii, 237, and Takabayashi, *ibid.*, 1897, ii, 585).—Maize plants grew equally well in solutions containing sodium nitrate and ammonium sulphate, provided that the strength of the latter solution did not exceed 0.05 per cent. ; stronger solutions are injurious. When both salts are present simultaneously, the plant sometimes prefers the one and sometimes the other. Ammonium salts are, therefore, not inferior to nitrate when employed in suitable quantities.

Reference is made to the Rothamsted experiments on wheat as regards the application of ammonium salts, the assumption being that nitrification is comparatively slow until June as indicated by Dehérain's drainage experiments.* It is estimated that an application of 86 lbs. of nitrogen per acre would give a solution in the soil containing 0.075 per cent. of ammonium sulphate, and results are quoted indicating that this and larger amounts of ammonium salts are less beneficial than nitrate.

N. H. J. M.

Agricultural, Botanical, and Chemical Results of Experiments on the mixed Herbage of Permanent Grass-Land, Conducted for many Years in Succession on the Same Land. III. The Chemical Results. Section I. By SIR JOHN B. LAWES and SIR J. HENRY GILBERT (*Phil. Trans.*, 1900, B. 192, 139—210).—The experiments were commenced in 1856, and include about 20 plots, two unmanured and the rest with a variety of manures. The "agricultural results" and the "botanical results" obtained during the first 20 years of the experiments have already been

* The results of analyses of the drainage from the plots of the permanent wheat field at Rothamsted showed, however, that the nitrification of ammonium salts applied as manure to this soil is very rapid in October and November when the soil is sufficiently wet (compare *Abstr.*, 1883, 891). In October, just after the ammonium salts have been applied, the drainage contains small amounts of ammonia, but if it is collected about a week or ten days later, it contains practically nothing but nitrates.—N. H. J. M.

discussed (*ibid.*, 1880, Pt. 1, and 1882, Pt. 4) and the present paper deals with the chemical results (determinations of total nitrogen, and ash analyses) of the same period.

The consideration of the results of the ash analyses showed the importance of including carbon dioxide in the "pure ash," instead of excluding it, as has almost invariably been done hitherto. The ash constituents are, therefore, calculated as percentages of the ash after saturation with ammonium carbonate and drying at 120—130°. The amounts of carbon dioxide in the ash ignited at a low red heat, and the amounts required to form normal salts, reckoning all the phosphoric acid as tribasic, are given in separate tables.

The ashes of different crops vary very characteristically according to the amount of nitrogen which they take up. For example, red clover, a crop which yields large amounts of nitrogen, partly due to fixation, much of which is taken up in the form of nitrates, yields an ash characterised by containing much carbon dioxide, which presumably represents organic acid originally present in the plant. The conclusion is drawn that, besides any physiological function of the bases, their rôle is prominently that of "carriers of nitric acid," and that, after the assimilation of the nitrogen, the base is left in combination with organic acids. It is suggested "that at any rate a large amount of the nitrogen of the chlorophyllous vegetation on the earth's surface was derived from nitrates; whilst, so far as this was the case, the *raison d'être* of much of the fixed base found in the ashes of plants would seem to be clearly indicated."

"The mineral composition of the mixed herbage is very directly dependent on the supplies available within the soil. Indeed, the composition of the mixed produce was found to be a somewhat close reflection of the supplies available within the range of the roots. It was, in fact, more so than in the case of individual crops grown separately. It is at the same time obvious, that when the more functionally important constituents are available in relative abundance, those which are of less importance in this respect are taken up and retained in less amount than they otherwise would be; the result being determined in great measure by the character of the growth induced.

"Luxuriance, or vegetative activity, is intimately associated with the amount of nitrogen available and taken up. Further, chlorophyll formation to a great extent follows nitrogen-assimilation. But the results relating to the increased amount of the non-nitrogenous substance yielded in the mixed herbage under the influence of various manures, clearly indicate that the nitrogen, being taken up, and the chlorophyll formed, the carbon-assimilation, and the carbohydrate formation, depend essentially on the amounts of potash available."

N. H. J. M.

Flax. By JULIUS OLSCHOWY (*Bied. Centr.*, 1900, 29, 240—242; from *Zeit. Landw. Versuchswesen Oesterr.*, 1899, 34, 135 and 515).—A crop of flax, 5000 kilos. per hectare, withdrew 34.1 kilos. of potash, 17.3 kilos. of nitrogen, and 15.5 kilos. of phosphoric acid from the soil. The assimilation goes on until the green seed capsules are formed, a period which represents about two-thirds of the whole vegetative period of flax grown for the production of fibre. Up to the time of flowering,

the assimilation of the above constituents is gradual; during the flowering period, there is a sudden increase followed by a rapid decrease.

Superphosphate, potassium sulphate, and sodium nitrate had a marked effect when applied before the seed was sown, but had no effect when applied as a top dressing. The effect of nitrogen was to increase the yield of straw and to lower the production of seed. Potash, and, still more, phosphoric acid, increased both straw and seed production.

N. H. J. M.

Effect of Nitragin and Inoculation Soil on Yellow Lupins. By MAX ADLER (*Expt. Stat. Record*, 1900, 11, 515; from *Ber. Landw. Versuchs. Stat. Jena*, 1898, 19—20).—Lupins were grown in sandy soil in zinc pots; five without inoculation, five inoculated with nitragin, and five with inoculation from lupin soil.

Nitragin increased the corn and straw 34·4 and 12·2 per cent., whilst the increase after soil inoculation was, corn, 106·5, and straw, 42·9 per cent.

N. H. J. M.

Experiments with German, English, and French Varieties of Mangels. By FERDINAND WOHLTMANN (*Bied. Centr.*, 1900, 29, 242—247; from *Illust. Landw.-Zeit.*, 1899, Nos. 2 and 5).—The results of one year's experiments with 17 varieties of mangels, including the yields of roots and leaves, the weights of the roots, and the percentages of dry matter and sugar, are given. The results so far indicate that the best German varieties are hardly surpassed by any of the other varieties employed, but that greatest differences occurred in the yields of the German varieties.

N. H. J. M.

Sugar-Beet in 1898. By STONE, CLINTON, KINSELY, and CAVANAUGH (*Bied. Centr.*, 1900, 29, 254—256; from *Cornell Univ. Agric. Expt. Stat. Bul.*, 166, 1899).—Results obtained with eight varieties of sugar-beet are given.

Experiments on the effect of various manures, applied both alone and mixed, were made with Klein Wanzleben roots. Sodium nitrate alone greatly reduced the percentage of sugar and the purity coefficient.

N. H. J. M.

Mites in Beet-root Excrescences. By FR. BUBÁK (*Zeit. Zuckerind. Böhm.*, 1900, 24, 355—367).—The excrescences sometimes observed on sugar-beet are produced by mites (*Histiostoma Feroniarum*, Duf.). The latter do not occur in healthy roots, and cannot exist in the excrescences in presence of microbes. The excrescences consist anatomically of the same substances as the roots, but the fibrovascular bundles are very irregularly placed. As regards composition, it has been shown by Schacht, Strohmer and Stift, and Stoklasa that the excrescences contain much less sugar than the roots, sometimes only half as much; whilst Strohmer and Stift and Bartoš found that the percentage of nitrogen is much higher than in the normal portions of the roots. It has been suggested that the less amount of sugar in the excrescences may be due to greater respiration, but it is more probably owing to consumption of sugar by the mites. Strohmer and Stift found 0·25—0·35 per cent. of invert sugar in the excrescences, but it is thought unlikely that it occurs in the healthy excrescences on roots

when taken up. When the excrescences are kept for a short time, the percentage of sucrose is reduced by 2—3 per cent.; subsequently, the sugar completely disappears.

N. H. J. M.

Rational Feeding of Cows. By OSKAR HAGEMANN (*Expt. Stat. Record*, 1899, 11, 484—485; from *Landw. Jahrb.*, 1899, 28, 485—534. Compare this vol., ii, 39 and 103).—Two cows were fed during successive periods with (1) malt sprouts, (2) pea-nut cake meal with cocoa-shells and molasses, (3) linseed meal, (4) maize-cake meal, (5) malt sprouts and 500 grams of emulsified sesamé oil, and (6) sesamé oil in a weak alkaline emulsion, in addition to a basal ration of hay, straw, dried beet diffusion residues, and salt.

The results gave no indication that the fat of food affects the production of milk fat. The milk of period 4 contained the least fat; the greatest yield of milk fat, as well as the highest percentage in the milk, was in the second period, when the ration contained 218 grams of fat for a cow weighing 560 kilos.

It is thought that the percentage of fat in milk and the absolute amount of milk fat produced do not depend on the fat digested in the food, but on certain substances present in some foods, which in some cases stimulate the lacteal glands, and in others modify the cell activity of the glands so as to produce milk containing more fat. This would account for the fact that cocoa-shells and molasses increased the fat in the milk, and that maize-cake maintained the yield, notwithstanding the natural shrinkage, although the percentage of fat in the milk diminished.

The substance which gives the characteristic sesamé oil reaction was not transmitted to the milk.

N. H. J. M.

Feeding Experiments with Blood Molasses. By LILIENTHAL (*Bied. Centr.*, 1900, 29, 166; from *Landw. Presse*, 1899, No. 27).—Blood is preserved from decomposition by adding molasses, and blood molasses is now manufactured at all the large slaughter-houses in Germany. It may contain proteids, 17—19; fat, 2·3—3·5; and non-nitrogenous extract, 55—69 per cent.

Experiments in which horses received 4 lbs. of blood molasses in the place of 6 lbs. (out of 12 lbs.) of oats, gave satisfactory results. Good results were also obtained with cows which received 2 lbs. of blood molasses a day; the yield of milk was raised 2 litres a day, and the cows remained healthy. Further experiments will be necessary.

N. H. J. M.

Maize-germ Molasses as Food for Cows. By BERNHARD SCHULZE (*Bied. Centr.*, 1900, 29, 167—169; from *Fühling's Landw. Zeit.*, 1899, 524. Compare Abstr., 1899, ii, 448).—The food consists of 52·5 per cent. of molasses and 47·5 per cent. of maize-germs, and has the following percentage composition:

Water.	Nitrogenous matter.	Fat.	Non-nitrogenous extract.	Crude fibre.	Ash.
21·00	14·56	3·79	52·00	2·58	6·07

Feeding experiments with 6 cows were made, in which the cows received during four periods, besides hay (6 lbs.), clover hay (6 lbs.),

and sunflower cake (1 lb.), the following amounts of food: Periods 1 and 4, mangels (70 lbs.) and wheat husks (3 lbs.); period 2, mangels (62.5 lbs.), wheat husks (2 lbs.), and maize-germ molasses (2 lbs.); period 3, the same foods as (2) in amounts of 55, 1, and 4 lbs. respectively. The results showed that maize-germ molasses is exactly equivalent to mangels and wheat bran. N. H. J. M.

Feeding Cows with English Cake. By EBERHARD RAMM and E. MÖLLER (*Bied. Centr.*, 1900, 29, 234—235; from *Milchzeit.*, 1899, No. 18).—The cake consisted chiefly of cotton-seed meal, with a good deal of fibre and husks, and, in addition earth-nut, rice- and barley-husks, and small amounts of palm-kernel meal and molasses.

The results of feeding experiments showed that the cake had about the same value as earth-nut cake. The favourable results are attributed to the cotton-seed meal in conjunction with sugar. Owing, however, to the high percentage of crude fibre, the cake is not recommended. N. H. J. M.

Feeding Cows with Bassia-Nut and Palm-Bassia Cake. By EBERHARD RAMM and E. MÖLLER (*Bied. Centr.*, 1900, 29, 233—234; from *Milchzeit.*, 1899, No. 10, 15).—Bassia nuts are obtained from different varieties. The fat is used as food and for candles and soap, the residues being given to cattle. Bassia-cake contains: water, 8.75; proteids, 8.75; fat, 19.90; carbohydrates, 47.45; crude fibre, 9.75; and ash, 5.40 per cent.

The results of experiments with cows in which bassia-cake was compared with earth-nut cake showed that the two foods are very similar in value; the small amount of proteids is counter-balanced by the fat and carbohydrates, provided that the ration contains the necessary amount of proteids.

Similar results were obtained from cake resulting from the manufacture of oil from a mixture of palm-kernels (2 parts) and bassia-nuts (1 part); but it is thought preferable to utilise the two products separately. N. H. J. M.

Feeding Cows with Tropon. By EBERHARD RAMM and E. MÖLLER (*Bied. Centr.*, 1900, 29, 232—233; from *Milchzeit.*, 1899, No. 16).—The cows were fed with rations containing earth-nut cake and Finkler's tropon containing three times the normal amount of digestible proteid. The effect of the tropon was to increase the yield of milk by 0.216 kilo. and the dry matter free from fat by 0.04 kilo. The live weight was reduced by more than 1 per cent., and the percentages and yields of fat and dry matter in the milk were reduced. Tropon residues gave better results. N. H. J. M.

"Manur." By ALEXANDER ZEGA (*Chem. Zeit.*, 1900, 24, 264).—A cheese exported from Servia, prepared from the milk of cows or sheep. The milk is brought to the boiling point and when cold a mixture of butter milk, whey, and a specially prepared rennet is added. The cheese paste is pressed in cloth, slightly salted, and dried. Its composition is about as follows: water, 22.40—23.13; proteids, 17.35—16.80; fat, 52.86—51.22; carbohydrates, 3.41—4.32;

ash, 4.48—4.53; salt, 3.26—3.40. Calculated on the dry substance: proteids, 22.35—21.80; fat, 68.11—66.63 per cent.

It has no particular odour, tastes sweetish, and when cut leaves a perfectly smooth surface.

L. DE K.

Soil Analyses. By CARL VON FEILITZEN (*Bied. Centr.*, 1900, 29, 217—218; from *Svensk. mosskulturfören. tidskr.*, 1899, 271—282).—Determinations of total nitrogen, and of potash, lime, and phosphoric acid, dissolved by 12 per cent. hydrochloric acid, were made in several hundred samples of soils from the different provinces of Sweden. Forty-five per cent. of the samples contained more than 8000 kilos. of nitrogen per hectare, to a depth of 20 cm., and 33 per cent. less than 6000 kilos.; 13 per cent. contained more than 600 kilos. of phosphoric acid and 74 per cent. less than 400 kilos.; whilst as regards lime, 50 per cent. contained more than 4000 kilos., and 39 per cent. less than 3000 kilos. per hectare. The peat-land of Gothland was particularly rich in lime, 96 per cent. of the samples containing over 4000 kilos. per hectare.

N. H. J. M.

Effect of Carbon Disulphide on the Fertility of Arable Soil. By EWALD WOLLNY (*Bied. Centr.*, 1900, 29, 146—150; from *Vierteljahresschr. Bay. Landw.-rats.*, 1898, 319. Compare Oberlin, *Abstr.*, 1896, ii, 67, and Pagnoul, *ibid.*, 66).—The results of pot and field experiments showed that whilst the application of carbon disulphide to soil will destroy the vegetation more or less completely, the fertility of soil is generally considerably increased when the disulphide is applied some months before sowing the seed. The increased fertility, which cannot at present be explained, lasts over one or several vegetative periods and is followed, if no manure is applied, by a considerable falling off.

Nitrifying and other soil microbes, including the leguminous nodule-bacteria, are not destroyed by even large amounts of carbon disulphide; their activity is only temporarily suspended.

N. H. J. M.

Experiments on the Schultz-Lupitz System. By PAUL BÄSSLER (*Bied. Centr.*, 1900, 29, 154—157; from *Ber. Agr.-Chem. Versuchs u. Samenkontrol-Station Köslin* for 1897, 81).—Field experiments were made on various light and other soils to ascertain whether liming or marling, in conjunction with moderate amounts of mineral manures and green manuring with *Leguminosae*, would give, under the unfavourable climatic conditions of the Eastern provinces, results similar to those obtained by Schultz-Lupitz. The composition of the soils is given in each case; about half of them contained satisfactory amounts of phosphoric acid, but all were poor in lime, and some contained very little potash. Several of the experiments failed owing to unfavourable weather.

The potato crop of 1897, which was injured by drought, was scarcely benefited by minerals on the fields which had green manure. On one field, the crop was better after the ploughing in of serradella, containing 156.5 kilos. of nitrogen per hectare, than after lucerne containing 322 kilos. of nitrogen. The loosening of the subsoil raised,

in nearly every case, the percentage of starch (about 0·3 per cent.) in the tubers, and in the majority of cases also increased the crop.

N. H. J. M.

Composition of the Soil under Paved and other Manure Courts at different Depths. By ADOLF EMMERLING and H. WEHNERT (*Bied. Centr.*, 1900, 29, 157—158; from *Jahresber. Versuchs-Stat. Kiel.*, 1898, 23).—The conclusion is drawn that to ascertain the extent of the losses undergone by a manure heap, it is better to examine the drainage collected in a pit, than to analyse the different layers of soil; no analytical results are therefore given.

N. H. J. M.

Manurial Experiments on Irrigated Meadows. By MARIO ZECCHINI and R. NUOLI (*Bied. Centr.*, 1900, 29, 159—162; from *Staz. sper. agrar. ital.*, 1899, 32, 15).—Farmyard manure gave the greatest yield of hay. Mineral and bone superphosphate proved to be about equal in value, and no difference in value was found between sodium nitrate and ammonium sulphate.

N. H. J. M.

Nitragin. By D. DICKSON and L. MALPEAUX (*Jour. agr. prat.*, 1897, 61, i, 191—197).—Inoculation of soil on which leguminous plants had not been grown previously, increased the yields of vetches and white lupins from 113 and 236 grams to 152 and 282 grams respectively. In sand, inoculation with nitragin increased the yields of incarnate clover and white lupins from 111 and 204 grams to 167 and 250 grams.

The results of field experiments with the same plants showed that inoculation had very little effect. In both sets of experiments, application of nitragin to the soil gave better results than when the seed was inoculated. The percentage of nitragin in the produce was increased by inoculation. The composition of the clover and lupins, both inoculated and grown without inoculation, is given.

N. H. J. M.

Nitragin. By E. SCHRIEBAUX (*Jour. agr. prat.*, 1897, 61, i, 813—819).—Pot experiments were made in which clover and peas respectively were grown in sterilised sand both without and with addition of nitragin. In the case of clover, inoculation with clover-nitragin greatly increased the growth, whilst inoculation with pea-nitragin produced no nodules and had no beneficial effect on the growth. With peas, both pea- and clover-nitragin produced nodules; with pea-nitragin, the produce was increased by about 50 per cent., whilst clover-nitragin reduced the yield.

Experiments with clover grown in soil showed that nitragin had no effect; the soil already contained the microbes.

N. H. J. M.

Importance of Various Plants employed for Green-manuring, in Increasing the Amount of Nitrogen in the Soil. By H. C. LARSEN (*Bied. Centr.*, 1900, 29, 230—232; from *Tidsskr. Landbr. Planteavl.*, 1899, 5, 101—112).—Several kinds of plants were grown in pots containing 7 kilos. of light soil (N=7·03 grams per pot) with mineral manures. The non-leguminous plants, especially buckwheat, and some leguminous plants (vetches) left the

soil poorer in nitrogen, whilst the other *Leguminosæ* either had no effect on the amount of nitrogen in the soil, or else increased it.

As regards total nitrogen, the nitrogen of the soil, roots, and above-ground portions of the plants, there was a gain in every case with the *Leguminosæ*, the greatest gains being obtained with *Vicia sativa narbonneensis*, *Pisum arvense*, and *Melilotus albus*.

The portions of the plants left after taking samples were mixed with the soil, and left during the winter. Experiments with barley showed that manuring with buckwheat and mustard was not only much less effective than manuring with leguminous plants, but that less growth was obtained than without green manure. N. H. J. M.

Effect of Manuring on the Inner Processes of some Plants. By HERMANN MÜLLER (*Bied. Centr.*, 1900, 29, 225—226; from 7th *Jahresber. Wädensweil.*, 36).—Potatoes, celery, radishes, and carrots were manured with minerals with 10 and 30 grams respectively of sodium nitrate per square metre in addition; one bed in each case received minerals only. The effect of nitrate was soon very marked, especially in the case of celery. The yield from each bed is given. Increased yields were obtained in each case, except potatoes and carrots, under the influence of nitrate. The radishes on the nitrate beds were partly decayed; the average weight was, however, considerably increased by the larger amount of nitrate. The carrots were also in part decayed on the nitrate beds. The potatoes, however, did not decay, and the diminished yield is attributed to the formation of crusts on the surface of the soil, due to the nitrate. N. H. J. M.

Availability of Fertiliser-Nitrogen. By SAMUEL W. JOHNSON, EDWARD H. JENKINS, and W. E. BRITTON (*Ann. Rep. Conn. Agric. Expt. Stat.*, No. 21, for 1897. Compare this vol., ii, p. 42).—Oats were grown in pots containing soil from the maize field, to which the various manures were added. The following results show the availability of the different forms of nitrogen for oats: sodium nitrate, 100; dried blood, 73·3; dry ground fish, 63·9; ground bone, 16·7; tankage, 49·4; horn and hoof, 68·3; linseed meal, 68·9; cotton seed meal, 6·48; and castor pomace, 64·6. If the roots were to be excluded, the percentage availability would have to be reduced by about 12; even then, greater amounts, especially in the case of nitrate and dried blood, will be seen to have been assimilated in 1897 than in the previous experiments. In the experiment next described, Hungarian grass was grown in soil to which nitrate, cotton seed meal, and raw knuckle bone, free from tendon and grease, were added. The bone was in three degrees of fineness: (A) passed through holes $\frac{1}{16}$ inch in diameter; (B) through holes $\frac{1}{16}$ to $\frac{1}{8}$ inch; and (C) through holes $\frac{1}{8}$ to $\frac{1}{4}$ inch; the three grades contained 3·58, 3·88, and 4·08 per cent. of nitrogen. The nitrogen availability was as follows: sodium nitrate, 100; cotton seed meal, 57·9; bone (A) 11·5, (B) 8·5, and (C) 5·6. N. H. J. M.

Phosphates. By CONSTANT SCHREIBER (*Bied. Centr.*, 1900, 29, 162—164; from *Rev. gén. agron.* Compare *ibid.*, 1897, 26, 803).—Phosphorite and basic slag had no effect on the growth of lupins and

white beans owing, it is supposed, to the power possessed by these plants, as well as by vetches, of obtaining all the phosphoric acid they require from the soil. Mineral phosphates should not be applied for cereals, tobacco, flax, carrots, sugar-beet, potatoes, and maize, and it is not worth while to apply them to serradella, and incarnate, red and white clover. Mineral phosphates are, however, of use in the case of hemp, the *Cruciferae*, peas, vetches (!), and buckwheat.

As regards the use of mineral phosphates in different soils, it was found that results are only certain in the case of peat-land.

In experiments with peas, it was found that calcium carbonate was in every case injurious when mineral phosphates were employed, and that when the amount of carbonate was large, its effect extended to the next year. Similar results were obtained with mustard and with clover, when phosphoric acid was applied in the form of mineral phosphate; in conjunction with basic slag, however, calcium carbonate had practically no injurious effect.

N. H. J. M.

Basic Slag for Spring Manuring. By PAUL WAGNER (*Bied. Centr.*, 1900, 29, 218—220; from *Deut. landw. Presse*, 1895 [?], No. 21, 183).—Basic slag containing 85—95 per cent. of phosphoric acid, soluble in citric acid, can be applied at all times, and will at once be available. The whole principle of phosphate manuring consists in applying an excess of the manure until a further addition produces no effect; in subsequent years, just sufficient phosphate is applied to meet the requirements of the greatest possible crop. The phosphoric acid does not become unavailable. A meadow which only yielded 30 cwt. of hay per hectare was partly manured, in 1899, with basic slag (16 cwt. per hectare); the whole meadow received kainite (16 cwt. per hectare) at the same time (1889) and in each subsequent year. The effect of the one application of basic slag was to increase the yield of hay, not only in 1890, but in each subsequent year as well, the total increase (1890 to 1896) being 243 cwt. per hectare. The greatest increase was in 1894 (59 kilos.), five years after the manure was applied.

N. H. J. M.

Composition of Kraal Manure. By J. LEWIS (*Agr. Jour. Cape of Good Hope*, 1899, 15, 517—521).—Analyses of (1) eleven samples of sheep-dung deposits, and of (2) three samples of burnt kraal manure are given. The average composition of the air-dried substances are as follows:

	Water.	N.	Ash.	K ₂ O.	CaO.	P ₂ O ₅ .	Cl.
(1)	13.52	1.31	41.28	2.84	7.08	1.26	1.25
(2)	2.23	—	86.46	7.60	16.97	2.59	1.57

N. H. J. M.

Analytical Chemistry.

Acidimetry. By A. ASTRUC (*Compt. rend.*, 1900, 130, 1563—1564. Compare Abstr., 1898, i, 222; and this vol., i, 199; ii, 122).—*iso*-Ethionic acid behaves as a strong monobasic acid in the presence of phenolphthalein, litmus, rosolic acid, and Poirrier's blue. With methyl-orange, 0.95 mol. of the alkali is required to give the end point.

Sulphanilic acid may be titrated with the above indicators, including methyl-orange, in this respect differing from the aminobenzoic acids.

Meconic acid behaves as a dibasic acid towards all the indicators except Poirrier's blue; with this reagent, it exhibits a tribasic character.

Mellitic acid reacts as a tribasic acid towards methyl-orange; its hexabasicity is revealed by the use of the other indicators.

G. T. M.

Asbestos Filters. By OTTO LOHSE and P. THOMASCHIEWSKI (*Zeit. anal. Chem.*, 1900, 39, 158—161).—To furnish proof of the utility of Lohse's pattern of asbestos filters (Abstr., 1899, ii, 801), the authors have made numerous estimations of silver, chlorine, barium, sugar (by copper reduction), and nickel, with results which showed only small differences in the fourth significant figure. When the precipitate is to be heated in a current of gas, it may be collected on a layer of coarse crushed glass (2—4 mm.) above the asbestos plug. M. J. S.

Technical Gas Analysis. By C. SCHMIDT (*Chem. Centr.*, 1900, i, 923; from *J. Gasbel.*, 43, 231—232).—In the technical analysis of gases over water, after absorbing the carbon dioxide, heavy hydrocarbons, oxygen, and carbon monoxide, a residual gas is obtained consisting of hydrogen, methane, and nitrogen.

In order to analyse this with a sufficient degree of accuracy, 20 c.c. of the mixture are measured in a Bunte burette, mixed with 125 c.c. of air, and exploded. After absorption of the carbon dioxide formed in the explosion, the total contraction is read off, and the remaining free oxygen, which should occupy about 2—5 c.c., is estimated by absorption with phosphorus. The remainder consists of nitrogen, from which should be deducted the amount of nitrogen contained in the added air (air \times 0.791).

The following formulæ should be used:

$$H = \frac{4}{3}(K + C) - 2V_0 \quad CH_4 = V_0 - \frac{1}{3}(K + C),$$

in which V_0 is the oxygen consumed, C the contraction, and K the generated carbon dioxide.

L. DE K.

Estimation of Combined Hydrochloric Acid in Gastric Juice. By OTTO COHNHEIM and H. KRIEGER (*Chem. Centr.*, 1900, i, 996; from *Münch. med. Wochschr.*, 47, 381—382).—The authors estimate in the ordinary manner the joint acidity and the free acid, each in 10 c.c., of the filtered gastric juice; 10 c.c. are then precipitated with calcium phosphotungstate. (This solution is made by

preparing a 4 per cent. solution of commercially pure phosphotungstic acid, and neutralising this at the boiling point with calcium carbonate; the solution keeps, and 30 c.c. will always be sufficient.) The bulky precipitate is filtered off, and the acidity estimated in the filtrate, using rosolic acid or phenolphthalein as indicator; the difference between this and the total acidity represents the combined hydrochloric acid. If there should be a deficiency of free hydrochloric acid, the deficit is estimated in the usual way, and a known volume of standard hydrochloric acid, about 30—40 c.c. more than the deficit amounts to, is added; the amount of the deficit is to be deducted from the amount of combined acid found.

L. DE K.

Estimation of Chlorine in Gastric Juice. By G. MEILLÈRE (*Bull. Soc. Chim.*, 1900, [iii], 23, 404—405).—The chlorine existing as free hydrogen chloride is estimated by titration with standard baryta solution, using phenolphthalein as indicator. The total chlorine is determined in the solution obtained by evaporating the juice to dryness with excess of calcium carbonate and calcium nitrate, igniting at a low temperature, and extracting the residue with dilute acetic acid. It is useful also to estimate the chlorine in the residue obtained by evaporating the juice to dryness in a vacuum, and in the ash.

N. L.

Chemical Processes in the Stomach. By M. C. SCHUYTEN (*Chem. Zeit.*, 1900, 24, 234—235).—The author has investigated the behaviour of the following reagents, which are usually recommended in testing for minute quantities of hydrochloric acid, towards the more common organic acids: (1) Danilewsky's reagent (Tropæolin OO); (2) Boas's reagent (a mixture of resorcinol and sugar in aqueous or alcoholic solution); (3) Günzburg's reagent (a mixture of phloroglucinol and vanillin in alcoholic solution); (4) an alcoholic solution of Congo red. The conclusion arrived at is that, to prove the presence of free hydrochloric acid in the juices of the stomach, freshly prepared Boas's reagent must be employed, as this reagent is not affected by small quantities of free organic acids, with the exception of tartaric acid, whereas most of the other reagents mentioned are readily affected.

Further experiments have proved that neither carbon dioxide nor different types of fatty acids are capable of liberating free hydrochloric acid from sodium or potassium chloride by their mass action (compare Maly, *Zeit. physiol. Chem.*, 1877, 1, 74).

J. J. S.

Estimation of Ozone from Ozonisers of Large Dimensions. By EUG. ACKERMANN (*Chem. Zeit.*, 1900, 24, 235—236).—A criticism of the method now in vogue of passing a definite volume of ozonised air through a solution of potassium iodide acidified with sulphuric, hydrochloric, tartaric, or other acid, and titrating the liberated iodine.

The method gives very uncertain results, owing to the great technical difficulty of accurately measuring the volume of gas which passes through the iodide solution.

L. DE K.

An Addition to the Apparatus for Kjeldahl's Nitrogen Estimation. By H. MEHRING (*Zeit. anal. Chem.*, 1900, 39, 162—163).—In place of the bulb-tubes of various forms usually inserted between

the flask and condenser to arrest drops of the alkaline liquid, a wide tube, twice bent at obtuse angles in opposite directions, and with narrow ends for making the respective connections, is employed. In the straight, narrow, vertical tube connected with the flask, a column of condensed liquid, about 10 cm. high, collects, and washes the ascending vapour; the upper, narrow tube is bent to a swan-neck shape. Owing to its simplicity, the apparatus is but little liable to fracture, and excellent results are obtained by its use. M. J. S.

Estimation of Nitrous Acid. By GYSBERT ROMIJN (*Chem. Zeit.*, 1900, 24, 145—146).—A criticism of Erdmann's view regarding the importance of nitrous acid in water, and of his patented new reagent (a liquid, containing sodium sulphanilate, and hydrochloric acid, and a powder, a mixture of sodium 1-amino-8-hydroxynaphthalene-4:6-disulphonate with sodium sulphate; this vol., ii, 243).

The results obtained with this new reagent were less satisfactory than those got with Griess' reagent. L. DE K.

Estimation of the Phosphoric Acid available as Plant Food in Soils and Manures. By J. PLOT (*Chem. Centr.*, 1900, i, 996—997; from *Oesterr. Chem. Zeit.*, 3, 127—131).—In order to ascertain the available phosphoric acid in soils or manures, a solvent should be used which resembles as much as possible the juice contained in the root of the plant. The author has now prepared a solvent which is a close imitation of the juice of beet in respect to salts. 0.4004 gram of ferrous sulphate, 1.4616 grams of potassium sulphate, 3.7098 grams of calcium nitrate, and 2.890 grams of magnesium chloride are dissolved and made up to 1 litre. 7.0566 grams of crystallised sodium carbonate, 6.744 grams of potassium carbonate, and 0.2 gram of silicic acid are fused in a platinum crucible; the fused mass is dissolved in water and mixed with 2.75 grams of oxalic acid, 1.9840 grams of malic acid, 2.2994 grams of citric acid, 1.9396 grams of tartaric acid, and then diluted to 1 litre. Before use, equal parts of these solutions are mixed.

25 grams of air-dried soil, or 5 grams of a manure, are shaken for half an hour in a 500 c.c. flask filled with the liquid; the phosphoric acid is then estimated in 200 c.c. of the clear filtrate. The process is well adapted for soils. When dealing with manures, it must be remembered that their soluble phosphoric acid available as plant food may be reduced in quantity when applied to a particular soil. The true value of a manure is, therefore, best ascertained by first analysing the soil itself, and then another portion mixed with a definite amount of the manure. L. DE K.

Sodium Amylzanthate in Qualitative Analysis. By R. GRASSINI (*Chem. Centr.*, 1900, i, 922—923; from *L'Orosi*, 22, 369—372).—The author has used Papasogli's reagent (*ibid.*, 21, 265) (which consists of a yellow solution prepared by mixing equal volumes of 50 per cent. solution of sodium hydroxide, pure amyl alcohol, and carbon disulphide) for other metals beside nickel and cobalt, and has observed the following colour reactions: Silver in ammoniacal solution turns dark blood-red with 2—3 drops of the reagent; lead, in neutral

solution, gives an orange precipitate soluble in sodium hydroxide; mercurous salts give a brownish-black, mercuric salts a dirty yellow, antimony in hydrochloric acid solution (acid solutions require some more of the reagent) an orange, arsenic in acid solution a canary-yellow, tin in acid solution a brown, bismuth in acid solution a reddish-brown, cadmium in ammoniacal solution a bright yellow precipitate; copper in very dilute ammoniacal solution is coloured red, aluminium dissolved in a not too dilute solution of sodium carbonate (1 hydroxide) gives a white, gelatinous precipitate; iron, in a neutral or faintly acid solution, turns a deep yellowish-red; manganese behaves like iron, but the red colour is not so permanent. Chromium, zinc, calcium, barium, strontium, magnesium, potassium, and sodium gave no reaction.

The reagent is, therefore, useful for the identification of individual metals from the groups previously separated from each other by the usual methods.

L. DE K.

Direct Estimation of Calcium in Presence of Iron and Aluminium. By L. BLUM (*Zeit. anal. Chem.*, 1900, 39, 152—155).—In the estimation of calcium in iron ores and blast furnace slags, an important economy of time results from precipitating the calcium by ammonium oxalate from a solution which has not been freed from iron and aluminium, but in which the oxides of those metals are retained in ammoniacal solution by the presence of tartaric acid. For practical purposes, the results of the two methods agree closely, since the amount of the iron, aluminium, and manganese oxides precipitated with the calcium from the ammoniacal tartrate solution is almost exactly balanced by the calcium oxide which escapes precipitation. The method is confined, however, to substances containing less than 0.5 per cent. of manganese.

M. J. S.

Analysis of Calcium Carbide. By HUGO ERDMANN and M. VON UNRUH (*J. pr. Chem.*, 1900, [ii], 61, 233—236).—An apparatus is described in which a known weight of a sample of calcium carbide is allowed to fall into water; the gas evolved escapes after passing over soda lime and from the loss in weight of the apparatus the proportion of calcium carbide in the sample is calculated. The amount of acid required to neutralise the resulting calcium hydroxide is calculated and subtracted from the actual amount required, thus giving the proportion of lime present in the sample. The neutral insoluble residue is also filtered off and estimated.

R. H. P.

Evaluation of Commercial Calcium Carbide. By GAETANO MAGNANINI and F. VANNINI (*Gazzetta*, 1900, 30, i, 401—404).—A description is given of a simple apparatus for determining the volume of acetylene yielded by a given weight of calcium carbide.

T. H. P.

Volumetric Estimation of Mercuric Chloride in Dressings. By MARTIN LEHMANN (*Chem. Centr.*, 1900, i, 998—999; from *Pharm. Zig.*, 45, 238—239).—The author communicates a further process for the volumetric estimation of mercuric chloride (this vol., ii, 443). It is based on the action of phosphorous acid on mercuric chloride which yields mercurous chloride and phosphoric acid. The excess of phos-

phorous acid is then titrated with *N*/100 potassium permanganate or with *N*/100 iodine, using starch as indicator. The action of the phosphorous acid is complete within half an hour at 25–30°. As the solution does not keep, it must always be checked afresh.

If the dressings should be coloured by rosaniline, this may be removed by means of a little animal charcoal. Experiments to estimate the mercuric chloride by means of standard stannous chloride or by *N*/100 potassium ferrocyanide and potassium permanganate have failed to give accurate results.

L. DE K.

Dry Assay of Lead. By J. FLATH (*Chem. Zeit.*, 1900, 24, 263–264).—A series of experiments to show that the dry assay is quite accurate enough for technical purposes; in rich ores, the deficiency does not exceed 1.5 per cent., and it must be remembered that some accompanying metals such as copper and antimony partly pass into the lead regulus.

The most suitable composition of the flux intended either for an acid or a basic material is sodium carbonate, 70 parts; borax, 28 parts; and potassium hydrogen tartrate, 2 parts.

L. DE K.

Estimation of Iron in Tap Cinder. By L. BLUM (*Zeit. anal. Chem.*, 1900, 39, 156–157).—In consequence of the almost universal presence of vanadium in the slag from iron puddling, neither the permanganate nor the stannous chloride volumetric method is available for an exact estimation of the iron. The gravimetric method is the only trustworthy one. The hydrochloric acid solution of the substance (freed from silica) should be twice precipitated by boiling with ammonium acetate to eliminate manganese; the precipitate again dissolved in hydrochloric acid, and, after adding tartaric acid and excess of ammonia, ammonium sulphide added to precipitate the iron.

M. J. S.

Simple Method for Decomposing Chrome-iron Ore. By RUDOLF FIEBER (*Chem. Zeit.*, 1900, 24, 333).—0.5 gram of the finely powdered ore is fused in a platinum crucible with 3 grams of sodium potassium carbonate for 10 minutes; when cold, 3 grams of dry borax are added and the mixture is again fused by first heating for a short time over the flame of a Teclu burner, and then for 45 minutes over the blowpipe. If the decomposition is not yet complete, a further addition of sodium potassium carbonate should be made. It is not really necessary to use the blast; if time is no object, a prolonged heating over the flame of a large Teclu burner will answer the purpose.

L. DE K.

Tin in Preserved Meat; Its Estimation and the State in which it Occurs. By F. WIRTHLE (*Chem. Zeit.*, 1900, 24, 263).—Analyses are communicated of samples of tinned meat from 1 to 5 years old, and the percentage of tin is stated. Where the metal was found to be corroded, which nearly always had occurred at such spots as had been in contact with the fat, the cause of the corrosion was found to be due to the formation of basic stannous chloride. The following process, originated by Orfila, was used for the estimation of the tin.

120 grams of the meat (jelly, fat) are heated in a large porcelain

dish standing on an asbestos plate with 5 c.c. of strong sulphuric acid with constant stirring, adding gradually more sulphuric acid; in all about 15—20 c.c. In this way, after about 4—5 hours a porous, charred mass is obtained which is then powdered and burnt to ash in a porcelain crucible. The ash is now fused with a mixture of sodium nitrate and carbonate, the fused mass treated with water and saturated with carbon dioxide. After remaining overnight, the precipitate is collected, washed, dried, and fused in a covered crucible with potassium cyanide. The fused mass is dissolved in water, the insoluble matter collected, washed, and dissolved in hydrochloric acid. From this solution, the tin is then precipitated in the usual manner with hydrogen sulphide and weighed as oxide. To make sure, this may be fused again with potassium cyanide and once more precipitated with hydrogen sulphide.

L. DE K.

Tinned Fish. By ADELBERT RÖSSING (*Zeit. anal. Chem.*, 1900, 39, 147—152).—The examination of some tins in which sterilised cod-fish and lobsters had been preserved for some years showed that the metal had been strongly attacked and in some cases completely removed from the interior, being converted into a white crust containing stannic oxide, phosphoric acid, and iron. This effect seems to be due to the action of the phosphates and ammonia present. It is in no way connected with imperfect sterilisation, but may always be regarded as evidence of long keeping. Any putrefaction or alteration in the original fresh appearance of the contents of the tins is not to be ascribed to this chemical action on the metal (except in cases where the iron itself is strongly attacked), but is the result of want of cleanliness or of sufficient rapidity in the operation of tinning, or of insufficient sterilisation of the contents of the tin.

M. J. S.

A New Reagent for Phenolic Compounds. By G. CANDUSSIO (*Chem. Zeit.*, 1900, 24, 299—301).—Instead of ferric chloride as a general test for phenols, the author uses a 1 per cent. solution of potassium ferricyanide to which 10—20 per cent. of pure ammonia has been added. This solution has the advantage over ferric chloride that it may be applied to either acid or alkaline solutions. The test may be applied in three ways. (1) By adding the reagent drop by drop to the phenol. (2) By adding the phenol gradually to an excess of the reagent. (3) By adding the reagent drop by drop to a solution of phenol rendered alkaline with sodium hydroxide. The results are communicated in a lengthy table.

From this, it is shown (1) that the sensitiveness of the ferric chloride test and the new test is in some cases the same, but in other cases different, the iron test being generally the less sensitive; (2) that although the phenolic compounds give with ferric chloride a blue, and with potassium ferricyanide mostly a brown colour, there is generally produced a series of different colours or precipitates which are of practical importance; (3) that potassium ferricyanide gives with phenol and commercial guaiacol a brown, with β -naphthol a vermillion, with thymol and morphine a whitish-yellow, with synthetical guaiacol a flesh-coloured, and with eugenol a yellow precipitate; (4) that potassium ferricyanide gives with α -naphthol a

single colour, namely, a blackish-violet, whilst it also gives a single colour with sodium salicylate, vanillin, morphine, and phloroglucinol, namely, a yellow one; (5) that, on the other hand, phenol, guaiacol, creosote, resorcinol, orcinol, catechol, quinol, gallic acid, pyrogallol, and tannic acid give with the same reagent two or more colours in succession. The sensitiveness of the two reagents towards artificial guaiacol, commercial guaiacol, and creosote is remarkable, as it gradually decreases from the first to the third.

It is also worthy of notice that thymol gives with ferric chloride a precipitate soluble in alcohol, and with potassium ferricyanide a precipitate insoluble in that liquid, whilst eugenol behaves in the opposite way. Morphine, like thymol, also gives a precipitate with potassium ferricyanide insoluble in alcohol.

L. DE K.

Detection of Sucrose in Lactose. By JOHN LANDIN (*Chem. Zeit.*, 1900, 24, 211).—The sample is treated with strong sulphuric acid. If the lactose is pure, it turns pale yellow at first and then gradually becomes bright brownish-red, the acid itself showing a reddish colour. If, however, a small quantity of sucrose is present, the mixture assumes at once a dark colour and soon becomes dark brown or brownish-black, and the acid does the same. In the presence of much sucrose, the whole mass turns black at once.

If a quantitative estimation is required, this may be effected by taking the copper reducing power before and after inversion.

L. DE K.

Volumetric Estimation of Free Fatty Acids. By J. SWOBODA (*Chem. Zeit.*, 1900, 24, 285).—A standard solution of sodium hydroxide in alcohol is very unstable, whilst an aqueous solution may cause the precipitation of fatty matter, which must then be redissolved by warming. If the liquid to be titrated contains ether as well as alcohol, two layers are formed which necessitate vigorous shaking after each addition of the alkali.

These inconveniences are avoided by dissolving the fatty matter in a mixture of 1 part of absolute alcohol and 2 parts of amyl alcohol.

L. DE K.

Estimation of Salicylic Acid. By JOSEF MESSINGER (*J. pr. Chem.*, 1900, [ii], 61, 237—248. Compare W. Fresenius and L. Grünhut, *Abstr.*, 1899, ii, 580).—The author shows that the iodometric method of estimating salicylic acid described by him and Vortmann (*Abstr.*, 1890, 1473), but rejected by Fresenius and Grünhut (*loc. cit.*), is quite satisfactory if the iodine and sodium hydroxide are present in sufficient quantity. The process is also satisfactory for other phenols.

R. H. P.

Hübl's Iodine-addition Method. By PAUL WELMANS (*Chem. Centr.*, 1900, i, 926—927; from *Zeit. öffentl. Chem.*, 6, 86—96).—The author's object has been to prepare an iodine solution of great stability, and he now recommends the following liquid for determining the iodine number of fats: 30 grams of iodine, 30 grams of powdered mercuric chloride, and 500 grams of glacial acetic acid are put into a litre flask, and ethyl acetate is then added, leaving space sufficient for

the mixture to be effectively shaken. When solution is complete, the liquid is made up to a litre by adding more ethyl acetate. This solution being an excellent solvent for fats, the use of chloroform becomes superfluous.

A number of analyses are communicated showing the influence of time, temperature, and excess of iodine on the iodine number. With lard, the excess of iodine is of more influence than the time of action; with cotton-seed oil and oil of almonds, no difference is noticed. With castor oil, the results are influenced by the time of action; various kinds of poppy oil behave differently in that respect. With cod-liver oil, the results vary, first with the temperature, then with the time of action, and lastly with the excess of iodine.

The fat extracted from roasted cocoa or chocolate by means of ether, unless dried for several hours at 105°, shows far too high an iodine number. This is caused by the presence of acraldehyde, which may, however, be removed by washing the fat with water at 50°.

L. DE K.

Estimation of Urea in Urine. By ADOLF JOLLES (*Zeit. anal. Chem.*, 1900, 39, 137—145).—The methods of Knop, Hüfner, and Riegler are recognised as giving results in excess of the truth; the author finds that the methods of Pflüger (*Abstr.*, 1887, 90) and Freund and Töpfer (*Wein. Klin. Rundschau*, 1899, 371) give practically identical results, and the latter estimates correctly any artificial addition of urea to urine. In both methods, the use of the azotometer replaces advantageously the estimation of the nitrogen by Kjeldahl's process, and these methods may be further improved as follows:

Freund and Töpfer's Method.—Five c.c. of the urine mixed with 5 c.c. of 95 per cent. alcohol are evaporated to dryness in the water-bath. The residue is repeatedly extracted with absolute alcohol, the alcoholic extract filtered into a flask, and the alcohol distilled off. The residue is then treated with about 70 c.c. of a saturated ethereal solution of oxalic acid, the precipitate of urea oxalate collected on a filter, washed with ether until free from oxalic acid, then dried at 70—80°, dissolved in water, and brought into the reaction vessel of the azotometer, where it is treated with alkaline hypobromite in the usual way.

Pflüger's Method.—Ten c.c. of the filtered urine are mixed with 30 c.c. of water and a sufficient quantity of a hydrochloric acid solution of phosphotungstic acid (100 c.c. of hydrochloric acid of sp. gr. 1.124 + 900 c.c. of phosphotungstic acid, 1:10). The mixture is warmed on the water-bath for 15 minutes, left in the cold for 4 hours (which is found to be long enough), made up to 100 c.c., and filtered through dry paper; 25 c.c. are placed in the azotometer, and made alkaline before introducing the tube containing the hypobromite. With these proportions, each c.c. of nitrogen (at 760 mm. and 15.5°) indicates 1 gram of urea per litre of urine. The author furnishes a table of corrections for other pressures and temperatures.

M. J. S.

Estimation of Tannin. By LEOPOLD SPECHT and FRITZ LORENZ (*Chem. Zeit.*, 1900, 24, 170—171).—The method is based on the principle that safranin is precipitated as a tannin-antimony lake, and

that the excess of saffranine may be readily titrated with solution of ammonium hyposulphite. The difference in c.c. between this estimation and the check experiment is the measure for calculating the amount of tannin.

The authors used as standard tannin a preparation from Schering and Co., "Acid tannic leviss," the moisture which it contained being allowed for. The ammonium hyposulphite was always prepared fresh by mixing 50 grams of zinc dust with 100 grams of water, and gradually adding 600 c.c. of ammonium hydrogen sulphite of sp. gr. 1.16, previously neutralised with ammonia; the temperature should not rise above 36°. After settling, 75 c.c. of the clear liquid are diluted to 2 litres, introduced into a reservoir, and covered with mineral oil. This reservoir is connected in the usual way with a burette, the end of which dips into the liquid to be titrated, which is also covered with mineral oil to exclude air.

L. DE K.

Soil Humus. Some Sources of Error in Analytical Methods. By A. L. EMERY (*J. Amer. Chem. Soc.*, 1900, 22, 285—291).—Hilgard's process for estimating humus in soils, which is frequently employed, briefly consists in extracting the soil, previously freed from calcium salts, with dilute ammonia. The solution is evaporated and the residue dried to constant weight in a platinum dish, the contents are then ignited and the dish weighed. The author has found that this process is not trustworthy, as the soil contains soluble organic matter which gradually combines with the ammonia, thus increasing the weight.

The use of a 4 per cent solution of potassium hydroxide has also been tried for the purpose of extracting the humus after first extracting the calcium salts with dilute hydrochloric acid. It was found, however, that aqueous potassium hydroxide liberates ammonia from the soil and that part of this enters into combination with the organic matter whilst another small portion escapes, so that the estimation of nitrogen contained in the humus gives results below the truth. The last source of error may be prevented by leaching the soil with 4 per cent. solution of aqueous potassium hydroxide in a funnel which is closed at the top with a stopper through which the leaching solution is admitted by a separating funnel. The glass support of a Gooch crucible serves very well for the funnel holding the soil. The solution from the soil is run directly into dilute sulphuric acid, the bottle containing this being sealed with a U-tube containing sulphuric acid. Gentle suction may be applied to hasten the process. It is also stated that humus is not quite insoluble in even very weak hydrochloric acid.

L. DE K.

Detection of Albumin in Urine. By ADOLF JOLLES (*Zeit. anal. Chem.*, 1900, 39, 146—147).—With certain urines poor in chlorides, the author's mercuric succinate test for albumin (*Abstr.*, 1896, 344) has proved to be deficient in sensitiveness unless sodium chloride is also added. It is therefore recommended that the amount of sodium chloride in the reagent should be doubled. In making the comparative test, water is added to the acidified urine instead of the reagent. The presence of mucin or nuclealbumin does not interfere with this test.

M. J. S. Q

General and Physical Chemistry.

Effects of Dilution, Temperature, and other Circumstances on the Absorption Spectra of Solutions of Didymium and Erbium Salts. By GEORGE D. LIVEING (*Trans. Camb. Phil. Soc.*, 1900, 18, 298—315).—Except for a slight difference in the absorption at the more refrangible end, the spectra of the different salts of the same metal in dilute solution are similar. For the chloride and sulphate, the spectrum is the same in different dilutions, so long as the thickness of absorbent is proportional to the dilution: the spectrum of nitrate solutions is modified slightly with increasing concentration. The first of these facts is in accord with Ostwald's view that the spectrum common to all the salts is due to the metallic ions, but the second is against this interpretation: so also is the fact that the intensity of the didymium and erbium bands is not affected by rise of temperature or by addition of the acid with the same negative ion. The author regards the metallic bands as the outcome of chemical actions between the molecules of the salt and of the solvent, whilst the general absorption at the more refrangible end may be due to encounters of molecules without chemical change. A certain interval of freedom is postulated between the rupture of a molecule and the recombination of its parts with each other or with parts of other molecules; during this interval, the parts have a capability of vibrating such as they do not possess in combination. Increased concentration and higher temperature will mean more frequent ruptures, more frequent recombinations, and shortening of the interval of freedom. These effects will compensate each other, and leave the average number of absorbent parts independent of the concentration and the temperature.

When alcohol or glycerol is the solvent, the bands are more diffuse and generally shifted towards the red. When dry hydrogen chloride is passed into the alcoholic solution, the colour changes from pink to bluish-green. The paper is illustrated by reproductions of the photographs obtained.
J. C. P.

Phosphorescence of Phosphoric Oxide. By HERMANN EBERT and BERTHOLD HOFFMANN (*Zeit. physikal. Chem.*, 1900, 34, 80—86).—Phosphoric oxide is capable of phosphorescence in a high degree, and it retains this property even when all impurities, such as the lower oxides, are carefully excluded. The commercial preparation after illumination shows, in addition to the greenish phosphorescence characteristic of the pentoxide, a pale glow, due probably to oxidation of the lower oxides present. The spectrum of the light emitted by the pure pentoxide is continuous, with a maximum intensity in the green, and the phosphorescence is much more intense at lower temperatures.
J. C. P.

Relation between the Constitution and Fluorescence of some Substances. By JOHN THEODORE HEWITT (*Zeit. physikal. Chem.*, 1900, 34, 1—19).—A fluorescent substance absorbs light of one wave-length, and emits light of another wave-length, so that two distinct sets of vibrations are involved. The author points out that for a compound which can exist in two tautomeric forms, and thus oscillates between two positions, the condition of fluorescence will most probably be satisfied. The most favourable cases would be those where there is a doubly symmetrical tautomerism, and consideration of a number of these shows that such compounds exhibit strong fluorescence. The various classes of fluorescent substances are considered in the order adopted by Meyer in his paper on the same subject (*Abstr.*, 1898, ii, 105). There are substances which, whilst possessing the requisite constitution, show no fluorescence; in such cases, it is possible (1) that the light emitted is beyond the visible part of the spectrum, or (2) that there is a secondary tautomerism which hides the primary. On the other hand, there are fluorescent substances which do not possess a doubly symmetrical tautomeric structure; in such cases, there may be a high velocity of transition from the one form to the other.
J. C. P.

Uranium Radiation. By HENRI BECQUEREL (*Compt. rend.*, 1900, 130, 1583—1585).—Part of the photographically active radiation from uranium is deflected in a magnetic field in the same direction as cathode rays.

When a small quantity of a barium salt is added to a uranium solution and then precipitated in the form of sulphate, the precipitate shows marked radioactivity, and hence it would follow that uranium commonly contains small quantities of a highly radioactive substance, probably actinium. At the same time, the most carefully purified uranium and its compounds still show radioactivity, and the extreme products of a long series of fractionations of uranium nitrate by Lecoq de Boisbaudran show identical radioactivity, whether it is measured by photographic effect or by its influence in promoting electrical discharge.
C. H. B.

Uranium Radiation. By HENRI BECQUEREL (*Compt. rend.*, 1900, 131, 137—138. Compare preceding abstract).—When solutions of uranium salts were treated with barium chloride and the barium subsequently precipitated as sulphate, the precipitate carried down a radioactive substance emitting rays which are deviated in the magnetic field. On repeating the precipitation, further quantities of this product were removed from the uranium solution, the amount decreasing with each successive operation. The uranium salt, when thus treated, was found to be less active, but the diminution in its activity decreased as the precipitations were repeated until, after the twelfth operation, its emissive power became approximately constant. The precipitations were still continued, but the variations were now found to be irregular, the uranium obtained after eighteen operations being decidedly less active than that from the twelfth. The rays emitted from the crude salt penetrate aluminium more readily than glass, whereas the converse holds with the radiations derived from the

purified compound. The electrical conductivity of air, as induced by the rays from uranium, is diminished by one-half after twelve precipitations, and its value is only one-sixth of the original after the eighteenth operation.

G. T. M.

Photochemical Effects produced by the Hertzian Radiating Wire. By THOMAS TOMMASINA (*Compt. rend.*, 1900, 130, 1462—1465).—Luminous effects were observed about the radiating wire and these were photographed by placing the wire in direct contact with the sensitised gelatin plate. Illustrations are given showing the peculiar nature of the luminous radiations, and of the effect on them of iron and other metals, as well as of the differences resulting when the wire is sufficiently tense to also produce sound vibrations.

L. M. J.

Modification of Metallic Surfaces under the Influence of Light. By H. BUISSON (*Compt. rend.*, 1900, 130, 1298—1300).—It is well known that metals exposed to ultra-violet radiations rapidly lose negative charges of electricity, being in this respect far more active when freshly cleaned. Light, however, causes a decrease of this activity, which is regained when the metal is kept for some time in the dark; this effect is very marked for amalgamated zinc. There is also a difference of potential between the surfaces of a darkened and illuminated metal, which may reach 0.125 volt. Most metals are more electro-negative after illumination, but the reverse obtains for platinum, whilst gold, silver, and iron are not affected. Red or yellow glass cuts off the rays effecting this change, but colourless glass does not, whilst ultra-violet rays have a reverse effect, so that the electric arc has little effect if not screened by colourless glass. The wavelength of the rays which separate the radiations thus acting in opposite directions is, for zinc, about 0.310μ . The action is not affected by the external atmosphere, similar results being obtained in hydrogen, carbon dioxide, &c. Amalgamated zinc, exposed to light through a screen and then exposed to iodine vapours, was also found to be least attacked in the illuminated portions, and hence to give an image of the screen.

L. M. J.

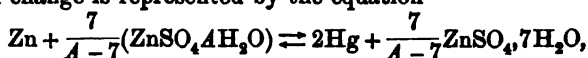
Brazilin and Hæmatoxylin as Photographic Developers. By ROBERTO LEPETIT (*Bull. Soc. Chim.*, 1900, [iii], 23, 627—631).—Hæmatoxylin and brazilin, dissolved in aqueous sodium hydroxide, rapidly absorb atmospheric oxygen; the relative rapidity of absorption in the case of pyrogallol, quinol, hæmatoxylin, brazilin, and catechol is, with equal concentrations, given by the numbers 5:15:25:30:40. The rapidity with which the substances develop a photographic plate under similar conditions is determined by a similar ratio; pyrogallol, however, although more rapid than quinol, leaves the plate under developed to a greater extent than the latter. Catechol is wholly unsuitable for use as a developer.

W. A. D.

Refutation of [Poynting's Theorem]. By P. S. WEDELL-WEDELLSBORG (*Zeit. physikal. Chem.*, 1900, 33, 631—635. Compare *Abstr.*, 1898, ii, 61).—A continuation of the author's previous papers on this subject, in which he holds that Poynting's theorem is erroneous on the following grounds. It is not in accord with the fundamental

laws of energy, with experimental results, with the laws of induction, and with modern theories of electrolysis. L. M. J.

Thermodynamics of Normal Cells. I. By ERNST COHEN (*Zeit. physikal. Chem.*, 1900, 34, 62—68).—On the basis of the equation $E = E_c/ne_0 + T.dE/dT$, and from the electrical measurements of Kahle, Jaeger and Wachsmuth, and of Callendar and Barnes, the author shows that the usual way of representing the process that goes on in the Clark cell is inadequate. Instead of $\text{Zn} + \text{Hg}_2\text{SO}_4 \rightleftharpoons 2\text{Hg} + \text{ZnSO}_4$, the essential change is represented by the equation



where A is the number of water molecules present for every one of ZnSO_4 in the saturated solution. If this is regarded as the true mechanism of the reaction, then thermochemical data give $E_c = 81127$ cal., whilst the electrical measurements give $E_c = 81490$ cal. Similarly, in the case where the zinc sulphate is present as hexahydrate, E_c from thermochemical sources is shown to be 75159 cal., whilst the electrical measurements lead to the value 75677 cal. J. C. P.

The Weston Cell as a Transition Cell and as a Standard of Electromotive Force, with a Determination of the Ratio to the Clark Cell. By H. T. BARNES (*J. Physical Chem.*, 1900, 4, 339—348).—The E.M.F.'s. of a number of Weston cells were determined at temperatures varying from 0 to 40°. Above 15°, the values of the temperature were in good accord with the formula $E_t - E_{15} = -0.086(t - 15^\circ)$, the values being in millivolts. Below 15°, the values were not concordant; the curves representing the E.M.F. as a function of temperature, however, all converged to 15° and agreed above this temperature. Experiments to see if a sudden change in the E.M.F. may occur below 15° led to varying results; in some cells, a rapid increase occurred in the neighbourhood of 2°, in others the rise of the E.M.F. was continuous. The ratio of the E.M.F. of the Weston cell at 20° to that of the Clark cell at 15° was found to be 1.40658, agreeing very closely with the ratio 1.40663 found by Dr. Kahle for the standard cells in the possession of the Reichsanstalt. L. M. J.

New Electrolytic Cell for Rectifying Alternating Currents. By W. L. HILDBURGH (*J. Amer. Chem. Soc.*, 1900, 22, 300—304).—The cell $\text{Cu} | \text{H}_2\text{SO}_4 | \text{Pt}$ allows currents of low voltage to pass if the copper is employed as the anode, but if the current is reversed owing to the high polarisation, no current passes if the voltage is not too great, and hence such a cell may be used as a rectifier for low voltage alternating currents. This is not a very efficient arrangement, however, and a better form consists of a plate of platinised platinum (A), partly in sulphuric acid, partly in hydrogen, and a platinum wire (P) sealed into glass under the acid; the whole is contained in a sealed vessel. Currents may pass from A to P, generating hydrogen at P, which escapes in bubbles joining the gas above the acid; in the opposite direction, however, polarisation occurs, P becoming coated with a film of oxygen. For high E.M.F.'s, a number of these cells in series may be employed. L. M. J.

Reversible Electrodes of the Second Order with Mixed Depolarisers. By A. THIEL (*Zeit. anorg. Chem.*, 1900, 24, 1—64).—The electrodes dealt with are of silver, and the depolarisers used are (1) mixed silver chloride and bromide, (2) mixed silver bromide and iodide. The equilibrium between silver chloride and bromide when precipitated together from mixed solutions of potassium chloride and bromide by a quantity of silver nitrate insufficient for complete precipitation has been studied by Küster (Abstr., 1899, ii, 205); the author has now made a similar investigation with mixed bromide and iodide. He concludes that silver chloride and bromide mix in all proportions, whilst silver bromide and iodide are miscible only within certain limits. In agreement with this, an electrode of the second order, with mixed silver chloride and bromide as depolariser, shows a 'mixed potential,' that is, a potential between the values obtained when the depolariser is pure chloride or bromide; the absolute value of the potential depends on the relative proportions of chloride and bromide. When the depolariser, on the other hand, is mixed bromide and iodide, the electrode shows the potential corresponding with the more soluble depolariser, so long as it is present. The values obtained for the solubility of the silver halogen salts agree well with those of Goodwin (Abstr., 1894, ii, 305). J. C. P.

Determination of Electrical Conductivity with Direct Current Instruments. By J. LIVINGSTON R. MORGAN and W. L. HILDBURGH (*J. Amer. Chem. Soc.*, 1900, 22, 304—307).—By the use of the rectifier described by Hildburgh (this vol., ii, 520), the resistance of electrolytes may be found, using a galvanometer or ammeter in place of the telephone. The method described by the authors is a substitution method; an alternating current passes through the liquid of which the resistance has to be determined, then through a set of resistance coils the terminals of which are also connected through the rectifier and a galvanometer. The reading of this instrument is noted, and the electrolyte replaced by a variable resistance which is adjusted until the same reading is observed. A more sensitive arrangement may be obtained by a differential wound galvanometer, one set of coils being in circuit with one rectifier, and the second similar opposed coils in circuit with a rectifier in the opposite direction. L. M. J.

Electrolytic Deposition of Metals from Non-aqueous Solutions. By LOUIS KAHLBERG (*J. Physical Chem.*, 1900, 4, 349—354).—In order to test whether Faraday's law is valid for non-aqueous solvents, solutions of silver nitrate in pyridine, aniline, phenyl cyanide, and quinoline were electrolysed, and the weight of silver deposited compared with that deposited from an aqueous solution in the same circuit; the weights respectively were as follows, those from the aqueous solutions being given first: 0.7836 gram, 0.7819 gram; 0.1788 gram, 0.1780 gram; 0.1612 gram, 0.1603 gram; 0.2501 gram, 0.2452 gram. In the quinoline solution, there was evidence of a complicated reaction, as the silver was carbonaceous; in the other solvents, it was firm and white. Experiments with lead and antimony gave very similar results. The work must be con-

sidered as preliminary, but it certainly tends to show that Faraday's law is valid for the non-aqueous solutions. It was found also that silver can be completely deposited in a compact white form from solutions in pyridine, or in aqueous pyridine by a current of density of from 0.17 to 0.25 ampere per 100 sq. cm. cathode area.

L. M. J.

Electrolysis of the Alkali Salts of Organic Acids. By JULIUS PETERSEN (*Zeit. physikal. Chem.*, 1900, 33, 99—120, 295—325, 698—720).—Compare Abstr., 1898, i, 352.

J. C. P.

Electrolysis through Semipermeable Membranes. By B. MORITZ (*Zeit. physikal. Chem.*, 1900, 33, 513—528).—The system, cathode | CuSO_4 solution | membrane 1 | K_4FeCy_6 solution | membrane 2 | CuSO_4 solution | anode, was electrolysed, and the polarisation was determined at membrane 2, where the semipermeable ferrocyanide was formed. The polarisation for primary currents of less than 0.3 milliampere was found to steadily increase and reach a maximum of 0.22 volt; with stronger currents, however, much higher values are attained. A formula is given for the polarisation as a function of time and its final maximum value, and is seen to satisfactorily reproduce the experimental values. A maximum of 1.006 volt was obtained for a primary current of 7.95 milliamperes per square centimetre, and the relative rates of change of polarisation and primary currents were found for various currents. Changes in the concentration of the solutions have but little effect on the polarisation, both in the above system and in that in which zinc sulphate replaces the copper sulphate. At first the copper ferrocyanide forms as a colourless film, this being most probably a supersaturated solution, and with weak currents this may remain for some hours, then becoming coloured brown with precipitation of the ordinary salt, whilst later, if the primary current exceeds about 0.2 milliampere per sq. cm., copper is precipitated. In the case of the zinc salt, however, this precipitation of the metal was not found to occur.

L. M. J.

Conductivity of Aqueous Solutions of Hydrochloric and Sulphuric Acids. By JAMES BARNES (*Trans. Nova Scot. Inst. Sci.*, 1900, 10, 129—138).—The author has calculated, by the method described by MacGregor (this vol., ii, 332), the conductivity of mixed solutions of hydrochloric and sulphuric acids, the assumption being made that the latter in moderately dilute solutions, as it does in very dilute solutions, dissociates into H and SO_4 ions. In the case of the solutions of from N to $2N$ concentrations, the calculated values are greater than those directly determined, whilst the reverse obtains for dilute solutions, but the differences in the latter case being almost within the experimental errors, the author considers that to seminormal concentrations the conductivity can be accurately calculated by Macgregor's method.

L. M. J.

Degree of Dissociation and Dissociation Equilibrium of Highly Dissociated Electrolytes. By HANS JAHN (*Zeit. physikal. Chem.*, 1900, 33, 545—576).—The determination of the degree of

dissociation by conductivity experiments involves the assumption that the ion velocities are independent of concentration: an assumption which has not been experimentally justified. The ion concentrations may, however, be compared by E.M.F. determinations, and in this case variations of velocity produce no effect. The author therefore determined the ion concentrations in solutions of potassium chloride, and by use of Kohlrausch's values for the conductivity obtained the ratios of the ion velocities at different concentrations. The velocity was found to decrease on dilution, so that ion concentrations calculated by the dilution law are necessarily too high, and values for E.M.F.'s calculated from the conductivity are considerably higher than the experimental values. The velocity had not reached its minimum at the concentration $N/300$, so that the ratio μ/μ_{∞} as a measure of dissociation is only valid for exceedingly dilute solutions. The values for the dissociation constant, as calculated from the conductivity values, also on this account decrease with dilution, but assuming complete dissociation at $N/600$, the values found from the E.M.F. determinations give a fairly constant value for the dissociation constant, the numbers varying irregularly from 0.14 to 0.10. Similar experiments were made and similar results obtained for solutions of sodium chloride and hydrogen chloride, and these elucidate the cause of the divergences from Ostwald's dilution law in the case of strong electrolytes.

L. M. J.

Electrochemical Equivalent of Carbon. By SIDNEY SKINNER (*Proc. Camb. Phil. Soc.*, 1900, 10, 261—267).—When a solution of potassium permanganate is electrolysed with a carbon anode, 77—86 per cent. of the gas liberated at the anode consists of carbon dioxide, the rest being carbon monoxide and oxygen. The total volume of gas liberated is nearly the same as the volume of oxygen liberated by the same current in a dilute sulphuric acid voltameter; the permanganate ion persists in solution even although a quantity of electricity more than sufficient for its complete decomposition is passed through the cell. The author finds the electrochemical equivalent of carbon to be three times that of hydrogen.

A cell may be constructed with a carbon rod in potassium permanganate, and a lead peroxide plate in dilute sulphuric acid, the two electrolytes being separated by a porous pot: the E.M.F. is 0.33 volt, and acts externally from the lead peroxide to the carbon. In this self-acting system, carbon is consumed at the ordinary temperature.

J. C. P.

Thermo-electrical Properties of Alloys. By ÉMILE STEINMANN (*Compt. rend.*, 1900, 130, 1300—1303).—The thermo-electromotive forces of junctions of pure lead with various alloys were determined, the alloys employed being ten varieties of nickel-steel, four of platinum-iridium, three of aluminium-bronze, five of bronze, five of brass, and four of German silver. The determinations were made with the hot junction at 55°, 95°, 140°, 195°, and 260°, the cold junction being in all cases at 0°. Tables of the values contained are given, and it is seen that the curves of the E.M.F. of the alloys would always lie either entirely within or entirely without those of the pure components, but the

position of the curve cannot be calculated from the percentage composition. No simple rule appears to connect the E.M.F. with the composition, and very small quantities of one metal may change very considerably the E.M.F. of another, this being very marked in the case of the addition of nickel to iron.

L. M. J.

Thermo-electricity of Certain Alloys. By ÉMILE STEINMANN (*Compt. rend.*, 1900, 131, 34).—Nickel steel containing 36.1 per cent. of nickel has between 0° and 100° an E.M.F. of -2461 microvolts; the E.M.F. developed from a specimen containing 28 per cent. of this metal between 20° and 260° is 385—386 microvolts, lead being in both cases the standard of comparison.

G. T. M.

Transparency of various Liquids to Electric Oscillations. By A. DE HEEN (*Compt. rend.*, 1900, 130, 1460—1461).—The liquids examined may be thus divided with regard to their transparency to electric oscillations: opaque—water, ethyl alcohol, amyl alcohol, aldehyde, carbon disulphide, ethyl bromide; transparent—ether, petroleum, benzene, xylene, butyric acid, valeric acid. For pure liquids there appeared to be no gradation, the liquid being either almost completely opaque or completely transparent, but with mixtures gradation may be obtained; 8 per cent. of alcohol reduces the transparency of ether to one-half, and 30 per cent. renders it quite opaque.

L. M. J.

Electromagnetic Rotation of the Plane of Polarisation in Solutions of Salts and Acids. By J. FORCHHEIMER (*Zeit. physikal. Chem.*, 1900, 34, 20—30).—Perkin has found that with falling concentration the molecular rotation of sulphuric acid solutions diminishes, whilst that of hydrochloric acid solutions increases. Oppenheimer (*Abstr.*, 1899, ii, 139) has shown that the molecular rotation of alkali bromides and chlorides is independent of the concentration of the solution. The author confirms Perkin's observations as to the acid solutions, and finds that the molecular rotation of ammonium, sodium, and magnesium sulphates is independent of the concentration, whilst that of lithium sulphate increases with falling concentration. Lithium chloride, as noticed by Perkin (*Trans.*, 1894, 65, 20), and confirmed by the author, behaves in a similar fashion. The molecular rotation of cadmium bromide and iodide does not vary with the concentration of the solutions, and is therefore independent of the electrolytic dissociation.

J. C. P.

Permanent Change and Thermodynamics. By PIERRE DUHEM (*Zeit. physikal. Chem.*, 1900, 33, 641—697).—A mathematical paper not suitable for abstraction.

J. C. P.

Specific Heats of Metals and the Relation of Specific Heat to Atomic Weight. By WILLIAM A. TILDEN (*Phil. Trans.*, 1900, A, 194, 233—255).—The specific heats of pure cobalt and pure nickel have been determined in Joly's steam calorimeter. The atomic weights and densities of these metals are close together, but the mean specific heat of cobalt between 15° and 100° is 0.10303, and that of nickel 0.10842. If 58.55 and 58.24 are taken as the atomic weights of

cobalt and nickel respectively, the corresponding atomic heats are 6.03 and 6.31. In the case also of gold and platinum, two metals whose atomic weights and densities are not very different, the atomic heats have quite different values, so that Dulong and Petit's law is not strictly applicable.

Determinations of the specific heat of various specimens of iron and copper show that the presence of a non-metallic impurity raises the specific heat of a metal; a non-metal as impurity has much more influence than a metal which produces little effect until the quantity is large enough to make itself felt through the difference in atomic weight.

A series of experiments have been made with cobalt and nickel at the temperatures of solid carbon dioxide (-78.4°), and boiling oxygen (-182.5°). The mean specific heats of the two metals for the various ranges of temperature are as follows:

Range.	Specific heat.	
	Cobalt.	Nickel.
100° to 15°	0.10303	0.10842
15° „ -78.4°	0.0939	0.0975
15° „ -182.5°	0.0822	0.0838
By calc. -78.4° „ -182.5°	0.0712	0.0719

It is seen that the specific heat of nickel falls more rapidly than that of cobalt, and that the two specific heats approach each other. For the range last given, the mean atomic heat of both metals would be 4.

J. C. P.

Specific Heats of Fluids. By ÉMILE H. AMAGAT (*Compt. rend.*, 1900, 130, 1443—1447).—The pressure coefficient of the specific heat at constant volume is given by the expression $dc/dp = -AT.d^2v/dt^2$, and from the complete set of isothermals for carbon dioxide between 0° and 260° , and from 1 to 1000 atmos., the author has constructed the curves for d^2v/dt^2 for various temperatures and pressures from which the variations of the specific heat at constant volume can be deduced. The curves show that this constant increases with pressure, reaches a maximum, and then decreases, the pressure at which the maximum occurs increasing with temperature. Below the critical temperature, the curve consists of two separated portions, and the author gives a form of expression for the calculation of the difference between the specific heats in the liquid and gaseous states.

L. M. J.

Thermal Conductivity of Nitrogen Peroxide as affected by Change of Temperature and Pressure. By GAETANO MAGNANINI and V. ZUNINO (*Gazzetta*, 1900, 30, i, 405—435. Compare Magnanini and Malagnini, *Abstr.*, 1898, ii, 282).—The former experiments (*loc. cit.*) on the thermal conductivity of air, hydrogen, carbon dioxide, and nitrogen peroxide are extended to pressures greater than that of the atmosphere. The results show that, as before, air, hydrogen, and carbon dioxide obey Newton's law, the expression $1/t \cdot \log.(d_1 - d_0/d - d_0)$ having a constant value. For nitrogen peroxide, which dissociates on heating, this is not the case, but the numbers obtained are in complete accord with the kinetic theory of gases. Thus, at high temperatures,

the conductivity of nitrogen peroxide is less than that of hydrogen, whilst for temperatures at which the change in the amount of dissociation is greatest, the conductivities of the two gases are about equal.

T. H. P.

Effect of very Low Temperatures on the Colour of Compounds of Bromine and Iodine. By J. H. KASTLE (*Amer. Chem. J.*, 1900, 23, 500—505).—On cooling to the temperature of liquid air, a marked decrease occurs in the intensity of colour of lead iodide, phosphorus pentabromide and heptabromide, mercuric bromiodide, iodoform, benzenedibromosulphonamide, tribromophenol bromide, mercuric iodide, bromine, iodine in solution in alcohol or carbon disulphide, sulphur, red-phosphorus, chrome alum, manganous chloride, chromic chloride, and alkaline alcoholic solutions of phenolphthalein and *p*-nitrophenol: the colour in many cases disappears altogether. No change was observed in the colour of solid iodine and of hydrated copper sulphate.

T. M. L.

Minimum in the Molecular Lowering of the Freezing Point of Water, produced by Certain Acids and Salts. By VICTOR J. CHAMBERS and JOSEPH C. W. FRAZER (*Amer. Chem. J.*, 1900, 23, 512—520. Compare Jones and Chambers, *this*, vol., ii, 262).—Minima in the molecular lowering of the freezing point of water occur in the case of phosphoric acid at about 0.5*N*, hydrochloric acid and sodium acetate between 0.1*N* and 0.2*N*, zinc chloride and strontium iodide at about 0.1*N*, and a less defined minimum in the case of copper sulphate at about 0.9*N*.

T. M. L.

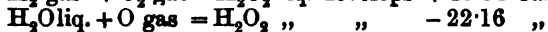
Depression of the Freezing Point by Mixtures of Electrolytes. By JAMES BARNES (*Trans. Nova Scot. Inst. Sci.*, 1900, 10, 139—161).—In order to test Macgregor's formulæ (this vol., ii, 332), the author has compared the freezing point depressions in the case of mixtures of potassium, sodium, and hydrogen chlorides with those obtained by calculation by Macgregor's method. The details of the experiments are given, and it is seen that the author's results for the separate solutions agree well with those of Loomis. The values found for double and triple mixtures agree well with those calculated, and hence indicate the availability of the formulæ in question. L. M. J.

Heat of Neutralisation of Hydrogen Peroxide by Lime. By ROBERT DE FORCAND (*Compt. rend.*, 1900, 130, 1250—1251. Compare *this* vol., ii, 277).—The heat production, due to the addition of a solution of lime to solutions of hydrogen peroxide of varying concentration, was determined. Curves for heat produced against concentration of hydrogen peroxide were found to consist of three straight lines meeting at points corresponding with $\text{CaO}, 2\text{H}_2\text{O}_2$ and $\text{CaO}, 10\text{H}_2\text{O}_2$. The former indicates the production of the peroxide $\text{CaO}_2, \text{H}_2\text{O}_2$, or $\text{Ca}(\text{O} \cdot \text{OH})_2$, and the heat of formation is calculated as 7.42 Cals.

L. M. J.

Heat of Dissolution of Hydrogen Peroxide: Thermal Value of the Hydroxyl Function; Influence of Hydrogen and Carbon. By ROBERT DE FORCAND (*Compt. rend.*, 1900, 130, 1620—1622).—Hydrogen peroxide solutions containing from 35.31 to

85.93 per cent. of the peroxide gave heats of dissolution ranging from +0.071 Cal. to +0.403 Cal., and the curve representing these results shows that there is a definite hydrate of the composition $\text{H}_2\text{O}_2 + \text{H}_2\text{O}$, whilst the heat of dissolution of the pure peroxide is +0.46 Cal. It follows that



The heat of fusion calculated from that of water is -2.70 Cal., and the same value is obtained by taking the mean heat of fusion of water and glycerol.

Combining these results with the known results of the action of hydrochloric acid on sodium hydroxide and peroxide and the action of sodium on water, it follows that

$\text{H}_2\text{O}_2 \text{ sol.} + \text{Na}_2 \text{ sol.} = \text{H}_2 \text{ gas} + \text{Na}_2\text{O}_2 \text{ sol. develops } +63.15 \text{ Cal.}$, and hence the mean thermal value of the hydroxyl function in the solid state is +34.07 Cal. Comparison with the corresponding values in the case of glycol leads to the conclusion that this value is affected by the proximity of various elements, or groups of elements, in the same molecule.

C. H. B.

Acidity of Alcohols. By ROBERT DE FORCRAND (*Compt. rend.*, 1900, 130, 1768—1761. Compare preceding abstract).—In a former communication, the author expresses the acidic functions of water, hydrogen peroxide, and glycol in terms of the heat developed when the hydroxylic hydrogen is replaced by metallic sodium, the values for H_2O , $\frac{1}{2}\text{H}_2\text{O}_2$, and $\frac{1}{2}\text{C}_2\text{H}_4(\text{OH})_2$ being +31.19, +34.07, and +31.32 Cal. respectively. By subtracting the second of these constants from the third, the number -2.75 is obtained; this quantity is characteristic of the group CH_2 , and is called its "coefficient of influence."

The coefficients of influence of carbon, hydrogen, methyl, and methenyl CH are deduced in a similar manner, their values being +3.01, -2.88, -5.63, and +0.13 Cal. respectively.

By applying this reasoning to the homologous series of alcohols, the coefficients +28.4, +25.69, and $(28 - 2.75 \times n)$ are obtained respectively for the first two members and the general term. It follows from this that the C_4 alcohol should not possess any acidity; this, however, is not the case, and the anomaly probably arises from the fact that the calculated coefficients of the two lowest members are less than the experimental values. Moreover, in straight chain compounds, the influence of a radicle probably diminishes as the distance from the hydroxyl group increases. The latter hypothesis is confirmed by a thermochemical study of the acidity of trimethylcarbinol and malonic and succinic acids. The calculated difference between the acidities of malonic and succinic acids is 1.375 Cal., whereas the actual difference is only 0.730 Cal., or 1.375×0.535 Cal. Similarly, the difference between the observed acidity of trimethylcarbinol and the calculated value for $\text{C}\cdot\text{OH}$ should be 3×5.63 Cal.; it is, however, only $3 \times 5.63 \times 0.585$ Cal. Taking 0.56 as the mean factor of correction, this quantity is employed in accordance with the following rule.

When an acidic group is situated in an open chain compound, the

influence of any other radicle of the compound on the acidity is only 0.56% of what it would be if this radicle were directly attached to the acidic group.

When this correction is applied to the alcohols, the calculated values of the coefficients of acidity approximate fairly closely to those obtained by direct experiment. G. T. M.

General Theory of Acidity. By ROBERT DE FORCRAND (*Compt. rend.*, 1900, 131, 36—40. Compare preceding abstracts).—In extending the generalisations put forward in two previous communications, the author calculates the "coefficients of acidity" and "influence" for a series of organic and inorganic radicles. The calculated coefficients agree fairly closely with those determined experimentally, and although this theory of acidity is still incomplete, it should be possible, knowing the constitution of any compound containing acidic hydrogen, to deduce by the aid of the "coefficients of influence" either the acidity or the heat of fusion of the substance. The coefficients of acidity of carboxyl and hydroxylic hydrogen are +52.62 and +18.43 Cal. respectively; the coefficients of influence of carbonyl, hydroxylic oxygen, sodium, and sodoxyl, NaO, are +18.55, +15.54, -45.70, and -30.16 Cal. respectively. The calculated acidities of (solid) propionic, *n*-butyric, and *n*-valeric acids are +49.32, +49.23, and +49.20 Cal. respectively, whilst the experimental values for the first two in the liquid state are +52.46 and +52.36 Cal. The experimental and calculated values for malonic, succinic, and glyoxylic acids are practically identical. The coefficients of influence of sulphur, nitrogen, and phosphorus in their oxy-acids are +16.79, +2.25, and +30.39 Cal. respectively. The acidity of formic and oxalic acid is abnormally high, the calculated values of this constant being +51.01 and +52.62, whilst the experimental numbers are 53.69 and 57.70, respectively. This abnormal acidity may be due to association. The theory of acidity cannot, however, be applied to cyanogen derivatives and hydracids.

G. T. M.

Temperature Coefficient of Ester Hydrolysis. By T. SLATER PRICE (*Öfvers. K. Vet. Akad. Stockholm*, 1899, 56, 921—934).—The rate of hydrolysis of a number of esters in presence of *N*/4 hydrochloric acid has been determined at various temperatures from 0° to 50°. The results obtained agree closely with those required for the formula $\log k = -A/T + B$, and are summarised in the following table:

Ester.	Value of <i>A</i> .	<i>k</i> at 40°.
Methyl acetate.....	8663	0.006397
Ethyl acetate	8695	0.006485
Propyl acetate	8586	0.006497
<i>iso</i> Butyl acetate	8746	0.006461
Methyl propionate	8273	0.006898
Propyl formate	7409	0.01554

The value of *A* for esters of the same acid is the same; for esters of the same alcohol, *A* varies (compare Hemptinne, *Abstr.*, 1894, ii, 274; Löwenherz, *Abstr.*, 1895, ii, 107). J. C. P.

Vapour Pressure Relations in Mixtures of Two Liquids. I. and II. By A. ERNEST TAYLOR (*J. Physical Chem.*, 1900, 4, 290—305 and 355—369).—The boiling points and composition of the vapour were determined for mixtures of acetone and water at various pressures. The first paper contains only an account of the methods employed. The author shows that superheating is very difficult to avoid, and considers that sufficient precautions have not been taken in the past, especially as the superheating can frequently only be detected by varying the conditions of the experiment. A mixture of garnets with platinum or silver tetrahedra was found to be most effective for preventing superheating, but these, or any other substance used for the same purpose, must be present in large quantities, their volume being at least one-half that of the liquid.

The second paper contains solely the vapour pressure curves and the numerical data for mixtures of acetone and water, all theoretical considerations and the discussions being postponed to a later paper. Some points are, however, noticeable; for example, the great steepness of the acetone curve compared with that of water, so that the curves are much closer at low temperatures and spread out as the temperature rises. Further, the composition of the vapour at low concentrations is markedly different from that of the solution. Thus, when the solution contains about 10 per cent. of acetone, the vapour contains 80 per cent. These points, however, will probably be fully discussed in later papers. L. M. J.

Absorption of Nitrogen and Hydrogen by Aqueous Solutions of Dissociating Substances. By LEONHARD BRAUN (*Zeit. physikal. Chem.*, 1900, 33, 721—739).—The author has determined the absorption coefficients of nitrogen and hydrogen at temperatures between 5° and 25° for aqueous solutions of the non-electrolytes, carbamide, and propionic acid, and the electrolytes, sodium and barium chlorides. The relation $C_1/C_2 = 1$, where C_1 is the molecular concentration of the gas in pure water, C_2 that in the solution of an indifferent substance, at the same temperature and partial pressure, is satisfied in the case of carbamide and propionic acid, but is quite inapplicable to sodium and barium chlorides. For the solutions of the latter compounds, the empirical relation $(\alpha - \alpha')/Gm^{2/3} = \text{const.}$ is found to hold; here α and α' are the absorption coefficients in water and solution respectively, whilst Gm is the number of gram-molecules per unit of volume.

Compare the results obtained by Steiner (Abstr., 1894, ii, 345), Gordon (Abstr., 1896, ii, 154), and Roth (Abstr., 1898, ii, 18).

J. C. P.

Temperature of Maximum Density of Solutions of Ammonium Chloride, Lithium Bromide, and Lithium Iodide. By LOUIS C. DE COPPET (*Compt. rend.*, 1900, 131, 178. Compare Abstr., 1899, ii, 590).—The results are exhibited in tabular form. G. T. M.

Isohydic Solutions. By WILDER D. BANCROFT (*J. Physical Chem.*, 1900, 4, 274—289).—It is commonly considered that by the mixing of isohydric solutions, no dissociation change occurs, and similar considerations have been applied to dissociation in gases, that

is, the dissociation is supposed to be unaltered by the addition of one of the products of dissociation at the same pressure as its partial pressure in the system, also termed "isohydric." These considerations have, however, only limited validity as considered from the point of view of the mass-action law; it is shown that by the addition of "isohydric" hydrogen to a dissociated system of hydrogen iodide, the dissociation is decreased, whilst the addition of isohydric carbon dioxide to ammonium carbamate causes an increase of dissociation. The general case is investigated, and it is deduced that if the dissociation is represented by $aA = bB + cC + \dots mM$, and isohydric B is added, the dissociation is unchanged, decreased, or increased according as a is equal to, greater, or less than $b + c + \dots m - b$. Similar considerations hold for electrolytic dissociation; if the dissociation be $A_1 = bB_1 + cC_1 + eE_1$, and $A_2 = fB_1 + gC_2 + \dots hM_2$, then the dissociation will be unchanged if $b + c + \dots e = 1$ and $f + g + \dots h - f = 1$, but if either of these expressions be greater than unity, the dissociation of the corresponding salt will be increased, and conversely. In the case of strong electrolytes, the mixture of isohydric solutions must generally be accompanied by dissociation changes. It is calculated that by the mixture of equal volumes of $N/100$ solutions of potassium and sodium chlorides, a decrease of dissociation should occur for each salt; conductivity experiments, however, showed an increase of dissociation. This is apparently not in accord with Arrhenius' results (this vol., ii, 201), but the discrepancy is explicable in view of the results obtained by Jones and Knight, which prove that dissociation is decreased by the mixture of strong solutions, but increased by the mixture of dilute solutions of potassium and ammonium chlorides (Abstr., 1899, ii, 628). The results are still not in accord with the theoretical deductions, and it is possible that the explanation has to be sought for in the effect of the undissociated products on dissociation.

L. M. J.

Solubility of Mixtures of Salts having one Common Ion. By CHARLES TOUREN (*Compt. rend.*, 1900, 130, 1252—1254).—The solubility curve of potassium chloride in solutions of potassium bromide is not identical with that for the solubility in solutions of potassium nitrate, so that the two latter salts have not equal effects on the solubility of the chloride. The solubility curve for potassium bromide in solutions of potassium chloride was also determined, and it was found that these curves do not cut, but form one continuous curve. There is hence no point at which the two salts are in equilibrium with the solution, and but one solid phase exists at all concentrations, that is, mixed crystals of the two compounds are formed. The author points out that solubility determinations may hence be of value in cases of doubtful isomorphism (this vol., ii, 396).

L. M. J.

Solubility of Hydrated Mixed Crystals. III. By WILLEM STORTENBEKER (*Zeit. physikal. Chem.*, 1900, 34, 108—123).—A study of the mixed salts, cadmium and ferrous sulphates, and copper and manganese sulphates, on the lines of the author's previous work (Abstr., 1896, ii, 13; 1897, ii, 250). The limits for cadmium and ferrous sulphates are found to be:

	$(\text{CdFe})\text{SO}_4 \cdot 2\frac{1}{2}\text{H}_2\text{O}$.	$(\text{CdFe})\text{SO}_4 \cdot 7\text{H}_2\text{O}$.
Solution...	100—79·8 mol. per cent. Cd.	79·8—0 mol. per cent. Cd.
Crystals...	100—99·1 " "	36·6—0 " "

Similarly, for copper and manganese sulphates, the limits are:—

	$(\text{CuMn})\text{SO}_4 \cdot 5\text{H}_2\text{O}$.	$(\text{CuMn})\text{SO}_4 \cdot 7\text{H}_2\text{O}$.
Solution	100—15·9 and 10·27—0 mol. per cent. Cu.	15·9—10·27 mol. per cent. Cu.
Crystals	100—22·9 and 10·5 —0 " "	23·5—16·0 " "

In the last case, the solubility isotherms cut each other in two points.
J. C. P.

Separation in Alloys. By G. NANNES (*Öfvers. K. Vet. Akad. Stockholm*, 1899, 56, 735—744).—When a molten alloy of equal parts of lead and tin is kept in a bath so that the two ends of the containing tube are at different temperatures, the concentration of the tin increases at the cooler end. This phenomenon is observed in both vertical and horizontal tubes, although in the former the point of equilibrium is reached more rapidly, and the final difference in concentration is somewhat greater than in the latter. The melting point curve of lead-tin alloys shows that in a 50 per cent. alloy the lead is to be regarded as the solvent; the observations, therefore, agree with Soret's rule that, in a homogeneous solution, the parts of which are kept at different temperatures, the warmer part becomes more dilute and the cooler part more concentrated with regard to the solute. On the other hand, the final concentrations at the ends of the tube are not exactly in the inverse ratio of the absolute temperatures, as required by van't Hoff's theory.
J. C. P.

Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XVIII. Gypsum and Anhydrite. I. The Hydrate $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$. By JACOBUS H. VAN'T HOFF and E. F. ARMSTRONG (*Sitzungsber. K. Preuss. Akad. Wiss.*, 1900, 23, 559—576).—The hydrate $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ is conveniently prepared by warming 20 grams of gypsum with 50 c.c. of nitric acid of sp. gr. 1·4 for 18 hours at 40°; the crystals obtained are freed from acid by decantation, washed with alcohol, and dried.

The relative stability of the hydrates $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ and $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ can be deduced theoretically from their vapour tension curves, but previous researches have shown that the extreme slowness with which equilibrium is reached prevents an accurate and trustworthy determination of the vapour tension. The process may, however, be accelerated by the agency of solutions of sulphuric acid, nitric acid, sodium chloride, and magnesium chloride. The results obtained with solutions of sulphuric acid are not so satisfactory, probably owing to the comparative insolubility of calcium sulphate in the acid.

When sodium chloride is gradually added to water in the presence of gypsum, the boiling point rises regularly to the temperature at which the gypsum is converted into the hydrate $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$. Further addition of sodium chloride at this point produces no further rise of temperature until the conversion is complete. A similar constant level in the boiling point curve is obtained when a concentrated solution of sodium chloride and the hydrate $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ is diluted.

In this way, the conversion temperature is determined to be 101.45° , at which point the vapour tension of the hydrate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ is equal to an atmosphere. At 77.1° , by a similar experiment under reduced pressure, the tension is found to be 238 mm. At 25° , by moistening with magnesium chloride solutions of various concentrations, the tension is found to be 9.1 mm. From two of these values, and with the help of the equation $\log(p_g/p_w) = -q/2T + \text{const.}$, the vapour tension of the hydrate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ is calculated for intermediate temperatures; in this equation, p_g and p_w are the vapour tensions of the hydrate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ and water respectively; q is the heat liberated when 18 kilograms of water unite with the hydrate $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ to form gypsum.

It is a consequence of the above equation that at 107° $p_g = p_w$, and this point has been experimentally determined by the help of a dilatometer. Gypsum is therefore a compound whose melting point (107°) lies above its boiling point (101.45°). The conversion of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ into $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ accounts for the apparent diminished solubility of gypsum above 100° .

J. C. P.

Equilibria in the Partition of an Acid between Ammonia and Sparingly Soluble Metallic Hydroxides. By W. HERZ (*Zeit. anorg. Chem.*, 1900, 24, 123—126).—Beryllium hydroxide is apparently insoluble in ammonium salts, and therefore unsuited for investigation on the lines of the author's previous work (Abstr., 1899, ii, 752; 1900, ii, 68 and 337).

The equilibrium represented by the equation $\text{Cd}(\text{OH})_2 + 2\text{NH}_4\text{NO}_3 \rightleftharpoons \text{Cd}(\text{NO}_3)_2 + 2\text{NH}_4\text{OH}$, has been studied, and the results are similar to those obtained in the case of zinc (*loc. cit.*). An empirical expression of the type formerly employed fits in better with the experimental results than the expression deduced from the law of mass action.

J. C. P.

Molecular Transformation of Cinchonine: An Addition to the Theory of Catalytic Action. By RUDOLF WEGSCHEIDER (*Monatsh.*, 1900, 21, 361—387).—It is shown that the transformation of cinchonine by means of halogen acids into α -isocinchonine (Skraup, Abstr., 1899, i, 961) is an example of the case of auxiliary reactions considered by the author (this vol., ii, 199), but the mathematical discussion does not lend itself to abstraction. The author puts forward the view that catalytic acceleration of a chemical reaction in a homogeneous solution can be explained by assuming that there is a continuous succession of intermediate stages, which the catalytic agent is able to influence by reversible reactions with the substances present, and so bring about or accelerate the main reaction.

R. H. P.

Theory of Catalytic Reactions. By HANS EULER (*Öfvers. K. Vet. Akad. Stockholm*, 1899, 56, 309—333).—A general discussion of reaction velocity and the part played by catalytic agents. It is pointed out that there are no grounds for making a distinction between electrolytes and non-electrolytes, and the author regards all chemical substances as electrolytes. The study of the influence of the solvent and the temperature makes it probable that substances hitherto

regarded as non-electrolytes react through intermediary ions. Every catalysis is supposed to consist in an increase in the number of the ions concerned in the accelerated reaction. The author applies his theories to the special case of ester formation and decomposition.

J. C. P.

The Driving Tendency of Physicochemical Reaction and its Temperature Coefficient. By THEODORE W. RICHARDS (*J. Physical Chem.*, 1900, 4, 383—393).—The paper contains essentially a slightly modified treatment of the van't Hoff equation. It is pointed out that the study of pressure affords a more direct method of analysing the progress of a reaction than that of volume or concentration. The author uses the term 'reaction-metatherm' to indicate the relation between pressure and temperature in the equilibrium ratio. In the expression, which is of the form $d/dT \log p_1^{n_1} \dots T^U / p_2^{n_2} \dots = U/RT^2$, U represents the actual heat evolved, and is hence an expression of the theorem of Le Chatelier. The expression $\log p_1^{n_1} \dots / p_2^{n_2} \dots = k$ is that which represents the reacting tendency of the reaction at a certain temperature, and receives the name of the "driving tendency" of the reaction.

L. M. J.

G. Linck's Crystallographic Views. By WILHELM MUTHMANN (*Ber.*, 1900, 33, 1771—1774).—A criticism of Linck's proposal to correct the atomic weights of elements by the aid of crystallographic considerations (compare Abstr., 1899, ii, 415).

W. A. D.

Additive Nature of the Properties of Atoms. By STEFAN MEYER (*Ber.*, 1900, 33, 1918—1919).—According to the author, only those compounds whose molecular volumes are the true sum of the atomic volumes of their constituent elements possess properties which are the actual sum of the atomic properties of their constituents. When, in the formation of the compound, volume contraction or dilatation occurs, other physical constants, for example, magnetisation number (Abstr., 1899, ii, 587; 1900, ii, 7, 143, 385), molecular heat (Abstr., 1900, ii, 464), &c., vary from the true sum in the direction of the maximum or minimum of the atomic volume curve.

J. J. S.

Second Report of the Committee of the German Chemical Society on Atomic Weights. By the Members of the Committee: HANS LANDOLT, WILHELM OSTWALD, and KARL SEUBEERT (*Ber.*, 1900, 33, 1847—1883. Compare Abstr., 1899, ii, 86).—This report deals with the conclusions arrived at by the International Commission formed to consider atomic weights (*Ber.*, 1898, 31, 2949). The members of the Commission agree almost unanimously that the atomic weight of oxygen shall be taken as the standard, and equal to 16.00; the advantages of this value are dealt with in detail in the report. The atomic weights are to be given with so many decimals that the last figure is *certainly* correct to less than half a unit; calculations made with these weights will thus be of permanent value, and subject to no alteration as additional accuracy is obtained in future determinations.

W. A. D.

True Atomic Weights of Ten Elements Deduced from Recent Researches. By GUSTAVUS HINRICHS (*Compt. rend.*, 1900, 131, 34—36. Compare preceding abstract).—The author states that by employing his method of calculation (*Abstr.*, 1893, ii, 317), the exact atomic weights of hydrogen, carbon, oxygen, sulphur, chlorine, bromine, sodium, silver, barium, and boron are found to be very close to the values in ordinary use. The values of these constants published by the German Committee on atomic weights are incorrect, and by employing these data Gautier has introduced an error into his determination of the atomic weight of boron. G. T. M.

Thiele's Theory of Partial Valencies in the Light of Stereochemistry. By EMIL KNOEVENAGEL (*Annalen*, 1900, 311, 194—240).—An attempt to place a stereochemical interpretation on Thiele's theory of partial valencies (*Abstr.*, 1899, i, 554). The author's speculations involve the hypothesis that the difference between a double and a single linking depends on the intramolecular movements of the atoms concerned. M. O. F.

The Steric Aspect of Partial Valencies. By JOHANNES THIELE (*Annalen*, 1900, 311, 241—255).—A criticism of the foregoing paper, in which the author regards the Wunderlich model, employed by Knoevenagel in his discussion, as unsuitable for the further development of valency relations. M. O. F.

Lecture Experiments. Reversible Chemical Reactions. By W. LASH MILLER, and FRANK B. KENRICK (*J. Amer. Chem. Soc.*, 1900, 22, 291—300).—A number of incomplete reactions capable of being employed for lecture experiments illustrative of reversible reactions are described. An orange solution of ferric chloride with ammonium thiocyanate in equivalent quantities becomes dark red by the addition of excess of either compound, and colourless by addition of ammonium chloride, whilst the same solution also may be used to illustrate the effect of dilution. The reactions between bismuth chloride and water, and of ammonium with salts of copper or silver, are also suitable for lecture purposes. The dissociation of water vapour may be shown by heating platinum wire by means of an electric current in the neck of an ordinary distilling flask, and ammonia may be similarly dissociated. The change from sodium sulphate to sodium chloride and *vice versa* by the addition of the respective acids may be conveniently shown on the screen, the crystallisation taking place on lantern slides. The reaction between antimony chloride and hydrogen sulphide is also suitable for lecture purposes, and in this case the effect of temperature and pressure is also well seen. The authors describe a form of pressure pump for use in connection with the water mains by means of which a gas can be brought to the pressure of the mains in three or four strokes of the pump without coming into contact with any liquid. L. M. J.

Method for Testing Weights. By THEODORE W. RICHARDS (*Zeit. physikal. Chem.*, 1900, 33, 605—610).—An account of the method in use in the author's laboratory for testing and correcting for the relative value of weights employed in quantitative work. The

author does not claim any originality for the method, but insists strongly on its necessity in all quantitative determinations.

L. M. J.

Receiver for Fractional Distillation in a Vacuum. By LUCIEN FOGETTI (*J. Amer. Chem. Soc.*, 1900, 22, 360—361).—The new receiver consists of three separator funnels sealed together, each of the three bulbs being furnished with a side stopcock, the uppermost having an additional one which is connected with the vacuum pump. The condenser tube enters into the top bulb, connection being made by a ground glass joint or a rubber stopper if desired. The two stopcocks of the bottom funnel are closed, also the side stopcock of the middle funnel and the left side stopcock of the top funnel. The other stopcocks are opened and the second side stopcock of the top funnel is connected with the vacuum pump. When the first fraction has collected in the lower funnel, the stopcock of the middle funnel is closed and the second fraction is collected; the stopcock of the middle one is then closed and the third fraction collected in the top funnel.

The bottom funnel is emptied by opening both stopcocks. The lower one being again closed, the side one is connected with a second pump and the vacuum is restored. By opening the stopcock of the middle funnel, its contents flow into the bottom one and the operation is then repeated.

L. DE K.

Inorganic Chemistry.

Hydrogen Peroxide. By JULIUS WILHELM BRÜHL (*Ber.*, 1900, 33, 1709—1710).—The explosive substance previously described (*Abstr.*, 1896, ii, 163) cannot be acetic peroxide as suggested by Nef (*Annalen*, 1897, 298, 290, 327), and again by Bach (*Ber.*, 1900, 33, 1506), since its boiling point is much too high, and its instability is the only point of resemblance. The view that hydrogen peroxide is $\text{HO}\cdot\text{OH}$ is supported by its high dielectric constant (92.8 at 18°) and by the absence of electrical absorption.

T. M. L.

Action of Iodides and of Hydriodic Acid on Sulphur Dioxide. By ARMAND BERG (*Bull. Soc. Chim.*, 1900, [iii], 23, 499—501. Compare this vol., ii, 398).—When aqueous solutions of sulphur dioxide and potassium iodide or hydriodic acid are mixed, a yellow coloration is produced which is probably due to the formation of an unstable compound; it is not caused by free iodine. On keeping, and especially under the influence of light and heat, the yellow colour gradually disappears and one-third of the total sulphur present is deposited, whilst the remaining two-thirds is converted into sulphuric acid. A small quantity of iodide is thus able to bring about the decomposition of a large quantity of sulphur dioxide, without itself undergoing any permanent change.

N. L.

Action of Oxidising Agents on Alkali Iodides. By E. PÉCHARD (*Compt. rend.*, 1900, 130, 1705—1708. Compare Abstr., 1899, ii, 473).—The liberation of iodine from alkali iodides by oxidising agents is probably due to an intermediate formation of periodate. A cold solution of monosodium periodate interacts with iodides in the following manner: $3\text{NaIO}_4 + 2\text{NaI} + 3\text{H}_2\text{O} = \text{NaIO}_3 + 2\text{Na}_2\text{H}_3\text{IO}_4 + \text{I}_2$. The reaction is not instantaneous, the liberation of iodine being still incomplete after an interval of one hour. Moreover, the following reverse action, $\text{Na}_2\text{H}_3\text{IO}_4 + \text{I}_2 = 3\text{NaIO}_3 + \text{NaI} + 3\text{H}_2\text{O}$, occurs when a solution of disodium periodate is left in contact with iodine, the mixture, which at first is alkaline, gradually becoming neutral. The amount of periodate is estimated by means of standard potassium manganate, prepared by treating an alkaline solution of permanganate with potassium iodide (compare Job, *Compt. rend.*, 1899, 128, 1453). The liberation of iodine from an alkali iodide by ozone follows a similar course, periodate is produced and the ratio between the amounts of free and combined iodine corresponds with that required by the first equation. When slightly acidified hydrogen peroxide is added to potassium iodide solution, iodine and oxygen are liberated, and the mixture becomes alkaline; after 24 hours, however, the alkalinity disappears, and the amount of free iodine diminishes perceptibly. These phenomena are explained in the following manner: the peroxide oxidises the iodide and the solution becomes neutral, the action following the course indicated by the first of the equations given; this results in the formation of the alkaline disodium salt in the presence of which hydrogen peroxide decomposes rapidly, and after 24 hours the solution again becomes neutral in accordance with the second equation. G. T. M.

Viscosity of Sulphur at Temperatures above the Point of Maximum Viscosity. By C. MALUS (*Compt. rend.*, 1900, 130, 1708—1710).—The rate of crystallisation of sulphur rendered viscous by heating at 357° for 10 minutes and then maintained for some time at 100° , depends on the rate of cooling and the time of exposure to the latter temperature; it decreases as the latter increases to a minimum value of 5.25 seconds, which is attained after 5 to 6 hours. This limiting value is identical with that obtained for sulphur rendered viscous by heating at 357° for 3 hours, the rate of crystallisation for this modification of sulphur being invariable.

Sulphur maintained for some time either at 100° or 357° passes into the liquid state, but the tendency to regain the viscous condition which is absent from the sulphur heated at 357° persists in that modification which has lost its viscosity at the lower temperature.

G. T. M.

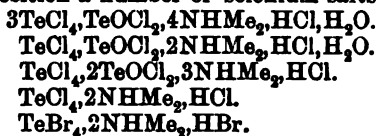
Caro's Reagent. By EUGEN BAMBERGER (*Ber.*, 1900, 33, 1959—1961).—The formula H_2SO_7 is suggested for 'Caro's reagent,' in accordance with Bach's view (this vol., ii, 470) that it is a compound of hydrogen tetroxide and sulphuric acid. On adding a copper salt and then sodium hydroxide to a solution of Caro's reagent, a brownish-black precipitate is produced which is regarded as copper peroxide.

By adding strong sulphuric acid to a cold solution of potassium percarbonate, a solution is obtained which oxidises aniline to nitrosobenzene,

and probably contains the same oxidising agent as a mixture of sulphuric acid with a persulphate or with hydrogen peroxide. T. M. L.

Isomorphism of Selenium and Tellurium. By JAMES F. NORRIS and RICHARD MOMMERS (*Amer. Chem. J.*, 1900, 23, 486—494).—The isomorphism of tellurium with selenium on the one hand, and with platinum on the other hand, has only been established in the case of certain compounds crystallising in the cubic system. Tellurium dimethylamine bromide and selenium dimethylamine bromide are, however, isomorphous, since they both form mixed crystals with tellurium dimethylamine chloride, although none of the crystals have been measured. The corresponding platinum dimethylamine bromide, which belongs to the orthorhombic system, does not form mixed crystals.

The following double salts of tellurium have been prepared, and resemble in composition a number of selenium salts :



Double salts containing tellurium and dimethylamine perbromide could not be prepared. T. M. L.

Combustible Gases of the Atmosphere: Air of Towns. By ARMAND GAUTIER (*Compt. rend.*, 1900, 130, 1677—1684).—The paper contains a detailed account and sketch of the apparatus employed by the author in estimating the amount of hydrogen and carbon present in the atmospheric gases.

The mean of a series of analyses of the atmosphere of Paris, made at different seasons of the year, indicates that this air contains 12·45 mg. of carbon and 3·96 mg. of hydrogen per 100 litres, the ratio of carbon to hydrogen being 3·1. Comparative experiments made with purified air containing traces of methane give the ratio as 2·4, indicating that, under these conditions, the hydrogen burns faster than the carbon. It follows from these results that it is still an open question as to whether the combustible gas of the atmosphere consists wholly of methane or of a mixture of this substance with hydrogen and hydrocarbons richer in carbon than the paraffins. G. T. M.

Combustible Gases of the Atmosphere: Air of Forests and High Mountains. By ARMAND GAUTIER (*Compt. rend.*, 1900, 131, 13—18. Compare preceding abstract).—The atmosphere of a forest in July contains only half as much carbon as the air of Paris, whilst the amount of hydrogen is somewhat smaller; the ratio C/H is 2·2, being less than that obtained with air containing traces of methane. Analyses of the air of Mt. Canigou, Pyrenees, indicated a still greater diminution in the amount of carbon, the ratio C/H being only 0·33; the hydrogen present is, therefore, almost entirely uncombined. These results indicate that the hydrocarbons existing in appreciable quantities in the air of towns and woods are, in all probability, emanations from the animals, plants, and humus present in these regions. G. T. M.

Combustible Gases of the Atmosphere: Air of the Sea. Existence of Free Hydrogen in the Terrestrial Atmosphere. By ARMAND GAUTIER (*Compt. rend.*, 1900, 131, 86—90. Compare preceding abstracts).—Examination of the air at the Roches-Douvres lighthouse, 40 kilometres from the coast of France, showed the almost complete absence of hydrocarbons, whilst free hydrogen was present in the proportion of 19.45 c.c. per 100 litres, the same amount as previously found in mountain air. These results confirm the conclusion that air normally contains about 1/5000 of its volume of free hydrogen together with variable quantities of hydrocarbons, the latter being due to the action of vegetable and animal life, to industrial operations, &c.
N. L.

Formation of Nitric Acid during the Combustion of Hydrogen. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1900, 130, 1662—1677. Compare this vol., ii, 474).—When compressed mixtures containing equivalent amounts of hydrogen and oxygen are exploded in the presence of nitrogen, neither ammonia nor nitric acid is produced, a similar result being obtained when the first of these gases is in excess.

When the mixtures contain excess of oxygen, the amount of nitric acid produced increases as the pressure is augmented. Equal volumes of oxygen and hydrogen were exploded in the presence of nitrogen under pressures of 2, 4, and 20 atmospheres; the amounts of nitrogen oxidised were respectively 25, 33, and 45 per cent. by weight of the total hydrogen consumed. When oxygen and hydrogen unite in the oxy-hydrogen blowpipe in an atmosphere of oxygen containing about 7 per cent. of nitrogen, the quantity of nitric acid produced is much smaller than in the preceding experiments. If the partial pressure of the hydrogen is kept constant, whilst the amount of oxygen is gradually increased, the ratio between oxidised and total nitrogen increases to 6.3 per cent. when the mixture contains 1 vol. of hydrogen to 2 vols. of oxygen, and then rapidly diminishes, becoming negligible when the mixture contains 5 vols. of the latter gas.

Experiments made with highly compressed mixtures (8—30 atmospheres) indicate that the yield of nitric acid increases with the pressure, and also to a certain extent with excess of oxygen. When larger quantities of nitrogen are employed, the yield of nitric acid increases considerably, the maximum being attained with the mixture $H_2 : O_2 : N_2 = 1 : 1.7 : 1.3$ under a pressure of 16 atmospheres; further dilution with this gas diminishes its oxidation, a mixture of 1 vol. of hydrogen and 4.5 vols. of air under a pressure of 5.5 atmospheres yielding only a trace of acid. The amount of nitric acid produced during the burning of a feeble jet of hydrogen in air is extremely small.

The paper contains the complete data of each determination of nitric acid, and concludes with a theoretical discussion of the results, which cannot be suitably abstracted.
G. T. M.

Supposed Allotropism of Phosphorus Pentabromide. By J. H. KASTLE and L. O. BEATTY (*Amer. Chem. J.*, 1900, 23, 505—509).—In attempting to determine the transition point from

yellow, rhombic phosphorus pentabromide into the red, prismatic variety, it was found that the latter is probably a perbromide of the formula PBr_7 . Its formation by subliming the yellow pentabromide at 90° is probably due to a partial decomposition into heptabromide and tribromide; phosphorus tribromide reconverts it into the yellow pentabromide. Bromine vapour converts the yellow pentabromide into the red compound, whilst when left in contact with bromine absorbents the reverse change takes place. In contact with water, phosphorus pentabromide gives a colourless solution of phosphoric and hydrobromic acids, whilst the red compound liberates free bromine.

On mixing phosphorus pentabromide and bromine in mol. proportions in a sealed tube and subliming at 90° , bright red, transparent crystals were obtained which gave $P = 5.40$, $Br = 96.20$, the calculated values for PBr_7 being 5.25 and 94.75.

T. M. L.

The Lower Oxides of Phosphorus. By ADOLPHE BESSON (*Bull. Soc. Chim.*, 1900, [iii], 23, 582—585).—A criticism of the work of Michaelis and Pitsch (this vol., ii, 137), whose experiments, it is considered, neither justify the conclusions drawn from them nor invalidate the author's previous proofs of the existence of an oxide of phosphorus of the composition P_2O .

N. L.

True Atomic Weight of Boron. By GUSTAVUS HINRICHS (*Compt. rend.*, 1900, 130, 1712—1714).—A note on Gautier's determination of the atomic weight of boron (compare this vol., ii, 14, 15). The mean value of this constant calculated by the author's method from Gautier's data is 11.004, that adopted by the latter investigator being 11.016.

G. T. M.

Expansion of Fused Silica. By HENRI LE CHATELIER (*Compt. rend.*, 1900, 130, 1703—1705).—Amorphous silica, prepared by fusion in the electric furnace, has between 0° and 1000° a mean coefficient of expansion 0.0000007; this constant is lower than that of any other substance. The melting point of this substance is lowered by the addition of the oxides of the alkali and alkaline earth metals and alumina, but the mixtures have greater coefficients of expansion, the increase being least in the case of the product $10SiO_2, Al_2O_3, 2Li_2O$.

G. T. M.

Preparation and Properties of the Silicon Borides SiB_3 and SiB_6 . By HENRI MOISSAN and ALFRED STOCK (*Compt. rend.*, 1900, 131, 139—143).—A mixture of 1 part of boron and 5 parts of crystallised silicon is heated for about 1 minute in a vessel of refractory clay by means of an alternating current of 600 amperes and 45 volts. The cooled mass is treated with a mixture of nitric and hydrofluoric acids in order to remove excess of silicon, and the crystalline portion of the residue after heating with moist potassium hydroxide is extracted with dilute nitric acid and hot water and dried at 130° . The product consists of a mixture of two borides, SiB_3 and SiB_6 , containing about 80—90 per cent. of the latter.

The hexaboride is readily oxidised by boiling nitric acid, whereas the triboride is only slowly attacked by this reagent; the latter compound,

on the other hand, is decomposed by fused potassium hydroxide, whilst the former remains unchanged.

The triboride forms black, rhombic plates which, when very thin, appear yellowish-brown by transmitted light; its density is 2.52.

The hexaboride is always obtained in thick, black, opaque crystals with somewhat irregular faces; its density is 2.47.

These silicon borides, like the boride and silicide of carbon, are very hard, being intermediate between the diamond and ruby in the scale of hardness; they are soluble in fused silicon and conduct electricity.

When gently heated, they are decomposed by fluorine and are attacked at higher temperatures by chlorine and bromine, but not by iodine or nitrogen. They become superficially oxidised by heating in air or oxygen. They are not affected by the haloid acids, but are slowly decomposed by boiling concentrated sulphuric acid, and rapidly dissolved by fused potassium carbonate or by a mixture of this compound with potassium nitrate; the latter salt alone has no action on them.

G. T. M.

Krypton. By ALBERT LADENBURG and C. KRÜGEL (*Sitzungsber. K. Preuss. Akad. Wiss.*, 1900, 212—217).—The least volatile portion of a large quantity (850 litres) of liquid air was freed from oxygen and nitrogen; the 3.5 litres of gas thus obtained were condensed in a bath of liquid air and under slightly increased pressure; the liquid formed was then allowed to boil, and the gas collected in separate vessels. The greater part came off at -181.2° ; the temperature then rose rapidly to -153° , when the rest of the liquid evaporated; a crystalline residue melted at -147° , and was rapidly vaporised. The first gas (boiling point -181.2°) showed a complete argon spectrum; that obtained from the crystalline residue showed a bright krypton spectrum, and careful investigation pointed to the absence of argon. The density of this krypton was found to be 58.81, and subsequent sparking with oxygen did not alter this value appreciably. The authors suggest that the new atmospheric elements should be placed before Group I of the periodic system, thus: He=4 before lithium, Ne=20 before sodium, A=39 before potassium, and Kr=59 before copper.

J. C. P.

Sodium and Potassium Amalgams. By ANTOINE GUNTZ and JULES FÉRE (Compt. rend., 1900, 131, 182—184).—The solution obtained by adding a mixture of sodium and mercury containing 3.5 per cent. of the former to the fused amalgam Hg_6K at 200° , deposits prismatic needles of the amalgam Hg_5K on cooling to 140° ; the mother liquor solidifies at 96° , and consists of the substance Hg_6K . When either of these substances is submitted to a pressure of 200—1200 kilos. per sq. cm., a saturated solution of sodium in mercury is expressed, and the residue consists of a new amalgam, Hg_4Na .

The ordinary potassium amalgam, $Hg_{12}K$, when compressed, is converted into a new amalgam, $Hg_{10}K$. A solution of potassium in mercury, when cooled to -19° , yields crystals of another potassium amalgam, $Hg_{18}K$; this substance, on warming, yields crystals of $Hg_{12}K$ and a saturated solution of potassium in mercury.

G. T. M.

Impossibility of the Direct Formation of Potassium Chlorate by Electrolysis. By ANDRÉ BROCHET (*Compt. rend.*, 1900, 130, 1624—1627).—When a solution of potassium chloride mixed with potassium hydroxide is electrolysed in presence of finely divided cobalt oxide, practically no chlorate is formed, and since the chlorate is not decomposed by cobalt oxide, the author regards this result as conclusive proof that the chlorate produced by electrolysis is always a secondary product from the hypochlorite, and is never a primary product, even in a solution so strongly alkaline that the intermediate formation of hypochlorite cannot be detected by analysis.

C. H. B.

Compound of Silver Fluoride with Ammonium Fluoride. By BRUNO GRÜTZNER (*Arch. Pharm.*, 1900, 238, 1—3. Compare von Helmolt, *Abstr.*, 1893, ii, 373).—By dissolving moist, freshly precipitated silver oxide in cold concentrated aqueous ammonium fluoride, and cooling with ice, a small quantity of a double salt, $2\text{NH}_4\text{F} \cdot \text{AgF} \cdot \text{H}_2\text{O}$, was obtained; this compound is not hygroscopic.

C. F. B.

Physicochemical Relations of Aragonite and Calcite. By H. W. FOOTE (*Zeit. physikal. Chem.*, 1900, 33, 740—759).—From experiments on the decomposition of aragonite and calcite by potassium oxalate, and on the conductivity of solutions of these two in water saturated with carbon dioxide, the author concludes that at the ordinary temperature calcite is more stable than aragonite, although the solubility curves deduced from the conductivity experiments approach each other with rising temperature. It seems probable, from the results obtained by the author and others, that under atmospheric pressure calcite remains the more stable form up to its melting point. The transformation of aragonite into calcite is accompanied by a slight evolution of heat.

J. C. P.

Formation of Marine Anhydrite. By HEINRICH VATER (*Sitzungsber. K. Preuss. Akad. Wiss.*, 1900, 269—294).—After reviewing the work done by others on the formation of anhydrite, the author describes experiments showing that at the ordinary temperature calcium sulphate crystallises from a saturated sodium chloride solution as gypsum and not as anhydrite; this holds also when the sodium chloride solution contains 3 per cent. of magnesium chloride. From saturated magnesium chloride solutions, calcium sulphate crystallises as gypsum at the ordinary temperature, and as the compound $2\text{CaSO}_4 \cdot \text{H}_2\text{O}$ at 40° .

J. C. P.

Solubility of Tricalcium Phosphate in Natural Waters in the Presence of Carbonic Acid. By TH. SCHLÖSING (*Compt. rend.*, 1900, 131, 149—153).—Hydrated tricalcium phosphate, $\text{Ca}_3(\text{PO}_4)_2 \cdot \text{H}_2\text{O}$, prepared by neutralising an aqueous solution of phosphoric acid with calcium hydroxide, is almost insoluble in distilled water at the ordinary temperature; it dissolves to a far greater extent in solutions of carbonic acid, but is much less soluble in water containing this acid together with an amount of calcium hydrogen carbonate corresponding with the pressure of the dissolved carbon dioxide. Since the latter condition usually obtains in surface waters, it follows that the carbon

dioxide present exerts but little solvent action on the calcium phosphate present in artificial manures.

The paper contains two tables showing the solubility of the phosphate in carbonic acid and calcium hydrogen carbonate solutions of varying strengths. G. T. M.

Influence of Temperature and Concentration on the Saline Constituents of Boiler Water. By CECIL H. CRIBB (*Analyst*, 1900, 25, 169—183).—The author communicates the analyses of a large number of boiler waters before and after boiling at different pressures and for different periods; the results are given in eleven tables.

Magnesium chloride, which is not decomposed by mere boiling with water, decomposes, however, at a higher temperature, and deposits magnesium hydroxide or even oxide. Calcium sulphate is not rendered insoluble at 150°, as has been stated.

Many obscure points have been noticed which want investigation before a clear idea is obtained as to what really takes place with the dissolved salts when waters are heated under pressure. L. DE K.

Solubility of Cupric Chloride in Organic Media. By WILLIAM ECHNER DE CONINCK (*Compt. rend.*, 1900, 131, 58—60).—A qualitative and quantitative study of the solubility of anhydrous and hydrated cupric chloride in a variety of organic liquids. G. T. M.

Copper Carbonate. By MAX GRÖGER (*Zeit. anorg. Chem.*, 1900, 24, 127—138).—The greenish-blue precipitate obtained by precipitating a solution of sodium carbonate with copper sulphate at the ordinary temperature is colloidal, and contains more or less absorbed sodium carbonate; when equivalent quantities of the two solutions are employed, the copper carbonate contains cupric oxide and carbon dioxide in the ratio $\text{CuO} : \text{CO}_2 = 2 : 1$. The amount of carbon dioxide in the precipitate decreases with the increase of excess of sodium carbonate, and with excess of copper sulphate the precipitate contains basic copper sulphates. The amount of water in the precipitate is variable, as is the case with all colloids. When the precipitate is allowed to remain in contact with the mother liquor, it becomes crystalline, and then has the composition expressed by the formula $6\text{CuO} \cdot 3\text{CO}_2 \cdot 4\text{H}_2\text{O}$; this change takes place more slowly as the excess of sodium carbonate increases, and with a large excess of sodium carbonate blue crystals of sodium copper carbonate, $\text{Na}_2\text{CO}_3 \cdot \text{CuCO}_3 \cdot 3\text{H}_2\text{O}$, are formed together with a small quantity of a dark brown copper carbonate.

The precipitate obtained from sodium hydrogen carbonate and copper sulphate at low temperatures is also colloidal, contains absorbed sodium hydrogen carbonate, has the ratio $\text{CuO} : \text{CO}_2 = 8 : 5$, and is not altered by drying at the ordinary temperature. When dried over sulphuric acid, it has the composition $8\text{CuO} \cdot 5\text{CO}_2 \cdot 7\text{H}_2\text{O}$. When precipitated in the presence of excess of copper sulphate, it contains basic copper sulphates, and when allowed to remain in contact with the mother liquor is gradually converted into the crystalline com-

pound $6\text{CuO}, 3\text{CO}_2, 4\text{H}_2\text{O}$. An excess of sodium hydrogen carbonate accelerates the change. E. C. R.

Distillation of Amalgams and the Purification of Mercury. By GEORGE A. HULETT (*Zeit. physikal. Chem.*, 1900, 33, 611—621).—The purity of mercury may be very accurately found by E.M.F. determinations; thus the E.M.F. of the chain $\text{Zn} | \text{electrolyte} | \text{Hg}$ is very greatly altered by the addition of small quantities of zinc to the mercury. Mercury may be conveniently distilled by means of an ordinary distilling flask fitted to an exhaust pump, as for the distillation of other liquids under reduced pressure, if a capillary tube be passed down into the mercury so that a fine stream of air or nitrogen passes through the metal during the distillation. Contrary to general statements, mercury is completely freed from zinc and cadmium by distillation, these metals not distilling over so long as the surface is bright. If, however, a film of oxide forms on the surface, some of this may be mechanically carried over. Determinations of the zinc indicate that at 210° the vapour tension of mercury is at least 3×10^7 times that of zinc. L. M. J.

Decomposition of Metallic Chlorides. By WILLIAM ECHSNER DE CONINCK (*Compt. rend.*, 1900, 130, 1627—1628).—When a dilute aqueous solution of mercuric chloride is filtered through animal charcoal, the salt is absorbed somewhat rapidly, but not completely, and it may be regarded as stable unless exposed to a very bright light. Cadmium chloride and aluminium chloride are somewhat slowly absorbed, and may be regarded as very stable, but stannic chloride, like the stannous salt, is rapidly decomposed with formation of an oxychloride. The rapid alteration of the stannous and stannic salts seems to show that the charcoal exerts an oxidising action. With ferric chloride solution, the charcoal seems to act as a dialyser, the whole of the iron being removed whilst the chlorine remains in solution. C. H. B.

Direct Formation of Crystallised Mercuric and Mercurous Iodides. By F. BODROUX (*Compt. rend.*, 1900, 130, 1622—1624).—If a somewhat concentrated aqueous solution of a mercuric salt, preferably the acetate, is mixed with a small quantity of methyl iodide and allowed to remain at the ordinary temperature, mercuric iodide gradually separates in red lamellæ as much as 10 mm. in breadth. Some of the first crystals are yellow, but gradually change to red. Other alkyl iodides behave similarly, but the yield is not so good.

Mercurous iodide can be obtained abundantly in yellow, lustrous plates by adding ethyl or methyl iodide to a cold saturated solution of mercurous nitrate. C. H. B.

Mercury Antimonide. By ALFRED PARTHEIL and E. MANNHEIM (*Arch. Pharm.*, 1900, 238, 166—184).—See this vol., i, 479.

Mercury Phosphide and Phosphonium Compounds. By ALFRED PARTHEIL [with A. VAN HAAREN] (*Arch. Pharm.*, 1900, 238, 28—42).—When hydrogen phosphide, prepared from sodium hypo-

phosphite, zinc, and hydrochloric acid, and therefore mixed with much hydrogen, is passed through dilute alcoholic mercuric chloride, a yellow precipitate of $\text{PHg}_2\text{Cl}, \text{HgCl}_2, 1\frac{1}{2}\text{H}_2\text{O}$ is obtained. When comparatively pure hydrogen phosphide, prepared from zinc phosphide and hydrochloric acid, is passed into a $2\frac{1}{2}$ per cent. solution of mercuric chloride in alcohol, a dark brown precipitate is obtained eventually, almost free from chlorine, but having approximately the composition $\text{P}_2\text{Hg}_3\text{O}_4$; this is unstable and readily evolves hydrogen phosphide. When hydrogen phosphide is passed over dry mercuric chloride, the hydrogen chloride liberated does not correspond with the formation of P_2Hg_3 .

Mercury phosphide, P_2Hg_3 , was prepared eventually, as a brown powder, by Granger's method (Abstr., 1892, 1398), and heated with ethyl iodide at 160° for 4—5 hours; in addition to mercuric iodide, a yellow *tetraphosphonium mercuriodide*, $\text{PEt}_4\text{I}, 2\text{HgI}_2$, was obtained. By digesting this in alcoholic solution with silver oxide, and evaporating the alkaline filtrate, a crystalline mass, doubtless of *tetraphosphonium hydroxide*, was obtained; from this, the crystalline, hygroscopic *chloride* was prepared by neutralisation with hydrochloric acid. The *mercurichloride*, $\text{PEt}_4\text{Cl}, 2\text{HgCl}_2$, *aurichloride*, $\text{PEt}_4\text{Cl}, \text{AuCl}_3$, melting at 179° , and *platinichloride*, $2\text{PEt}_4\text{Cl}, \text{PtCl}_4$, were also prepared. Some of these compounds were also prepared, for the sake of comparison, from triethylphosphine; the products were identical with those described already. The precipitate obtained by mixing tetraphosphonium iodide and mercuric iodide in alcoholic solution at the ordinary temperature has the composition $2\text{PEt}_4\text{I}, \text{HgI}_2$, but it is converted into the compound described above when it is heated at 160° with mercuric iodide and ethyl iodide.

By heating mercury phosphide with methyl iodide at 140 — 150° , some analogous compounds were obtained. *Tetramethylphosphonium mercuriodide*, $\text{PMe}_4\text{I}, 2\text{HgI}_2$, melting at 172° ; *mercurichloride*, $\text{PMe}_4\text{Cl}, \text{HgCl}_2$, melting at 249° ; *platinochloride*, $2\text{PMe}_4\text{Cl}, \text{PtCl}_4$, and *aurichloride*, $\text{PMe}_4\text{Cl}, \text{AuCl}_3$, were prepared.

C. F. B.

Ceric Sulphates. By WILHELM MUTHMANN and L. STÜTZEL (Ber., 1900, 33, 1763—1765).—When ceric oxide is dissolved in concentrated sulphuric acid and the solution evaporated, a yellow salt is first obtained, which is normal ceric sulphate, $\text{Ce}(\text{SO}_4)_3, 4\text{H}_2\text{O}$. The mother liquors often, but not always, yield a second salt, forming large, reddish-brown crystals, which are readily decomposed by water, with formation of insoluble basic substances. This substance has the composition $\text{Ce}_2(\text{SO}_4)_3, 2\text{Ce}(\text{SO}_4)_3, 20\text{H}_2\text{O}$, and is the only ceric sulphate which could be obtained in addition to the normal salt.

A. H.

Luminescence Spectra. By WILHELM MUTHMANN and E. BAUR (Ber., 1900, 33, 1748—1763).—The authors regard the luminescence spectra yielded by certain of the rare earths as of considerable value for their identification, in spite of the fact that these spectra are much affected by the presence of small quantities of other substances, such as lime, gypsum, &c. Detailed measurements and diagrams are given for lanthanum oxide, yttrium oxide, yttrium sulphates of various origins, and oxides and sulphates obtained from monazite and commercial thorium nitrate. The spectra of the yttrium sulphates, and of

the oxides and sulphates derived from monazite and thorium nitrate, are essentially made up of lines due to yttria and gadolinia, to the latter of which the authors ascribe four bands. By fractionation of a crude yttrium earth by ammonia, and crystallisation of the formate, each operation being repeated 50 times, an earth containing very little erbia is obtained, which shows strong lines of yttria and gadolinia. When this material is divided into about 20 fractions by means of potassium dichromate, the last of these contains only traces of erbia and very little gadolinia. Further fractionation with ammonia removes the remainder of the erbia, whilst the gadolinia accumulates in the last fractions. Thoria itself gives no luminescence spectrum, the spectra actually observed with the oxides and sulphates derived from monazite and commercial thorium nitrate being due to yttria and gadolinia.

The authors have not observed the independent disappearance of the single bands of the yttria and gadolinia spectra in the manner described by Crookes (*Trans.*, 1889, 55, 270), whilst, on the other hand, Crookes has not described spectra corresponding with those ascribed by the authors to almost pure yttria and gadolinia respectively.

A. H.

Natural and Artificial Pozzuolana. By GIOVANNI GIORGIS and Ugo ALVISI (*Gazzetta*, 1900, 30, i, 436—508. Compare this vol., ii, 348).—A discussion is given of the literature of the setting of hydraulic materials, followed by a bibliography of the subject.

T. H. P.

Chemical Constitution of Steels; Influence of Tempering on the State of Combination of Elements other than Carbon. By ADOLPHE CARNOT and GOUTAL (*Compt. rend.*, 1900, 131, 92—96. Compare *Abstr.*, 1897, ii, 520, 555).—It has been shown (*Abstr.*, 1897, ii, 555) that in slowly cooled steel, the sulphur present combines with the manganese in preference to iron, since treatment with cupric potassium chloride solution leaves an insoluble residue of cupric sulphide containing sulphur equivalent to the manganese present, whereas iron sulphide is not attacked by the solvent in question. Precisely similar results are obtained with tempered steel, whence it follows that tempering has no influence on the condition in which sulphur exists in the metal. The same applies to phosphorus, present as iron phosphide, Fe_3P , which is left undissolved when the tempered or untempered steel is treated with cupric potassium chloride solution. On the other hand, arsenic, which exists in the free state in untempered steel, is found to be present mainly as an iron arsenide, Fe_3As , in the tempered metal, this arsenide being left undissolved by treatment with 7 per cent. sulphuric acid with exclusion of air. Copper is present chiefly in the uncombined state in both tempered and untempered steel, as was shown microscopically after digestion with dilute acid or with a mixture of hydrogen peroxide and ammonium chloride solution. Nickel in tempered, as in untempered, steel appears to exist in the metallic condition, either mixed with or dissolved in the iron.

N. L.

Iron Selenides. By HENRI FONZES-DIACON (*Compt. rend.*, 1900, 130, 1710—1712).—The combination of iron and selenium at high temperatures always gives rise to compounds containing an excess of selenium over that indicated in the formula FeSe . Amorphous products only are obtained by the action of hydrogen selenide or selenium vapour on red hot iron. Ferric selenide, Fe_2Se_3 , produced by the action of hydrogen selenide on ferric oxide heated to bright redness, forms a grey, microcrystalline powder with a blue reflex.

The *selenides*, Fe_3S_4 and Fe_7S_8 , are obtained in a similar manner from the peroxide or anhydrous ferric chloride at somewhat higher temperatures; these compounds are crystalline, and belong apparently to the cubic system.

Iron diselenide, FeSe_2 , prepared in a similar manner at a dull red heat, forms pseudomorphs after crystallised anhydrous ferric chloride; when heated in a current of oxygen, it is oxidised to ferric oxide and selenium dioxide.

The higher selenides are all converted into the monoselenide by reduction with hydrogen; the subselenide, Fe_3Se , however, could not be obtained by this process. When the monoselenide is heated in the electric furnace, a portion undergoes complete dissociation, whilst the residue remains unaltered. The stability of the selenides towards hydrogen chloride or a concentrated solution of this gas increases with the percentage amount of selenium, the diselenide not being attacked. The selenium in these compounds is readily replaced by chlorine, and fuming nitric acid converts them into selenites. G. T. M.

Behaviour of Potassium Cobaltocyanide and of Chromous Compounds towards Oxygen Gas. By WILHELM MANCHOT and JOHANNES HERZOG (*Ber.*, 1900, 33, 1742—1748).—When a solution of potassium cobaltocyanide is rapidly oxidised by atmospheric oxygen, it is found that twice as much oxygen is absorbed as is necessary for the conversion of the cobalto- into the cobalti-cyanide, according to the equation $2\text{K}_4\text{CoCy}_6 + \text{H}_2\text{O} + \text{O} = 2\text{K}_2\text{CoCy}_6 + 2\text{KOH}$.

At the close of the reaction, moreover, the whole of the oxygen absorbed is found to be present in the form of hydrogen peroxide. On the other hand, when the oxidation is carried out slowly, the oxygen absorbed is only slightly in excess of that required by the equation, and a correspondingly small amount of hydrogen peroxide is present. This is due to the fact that in the first case the direct oxidation proceeds so rapidly that the slower, indirect oxidation by means of hydrogen peroxide does not occur to an appreciable extent, whilst in the second case this factor becomes of importance. When a solution of potassium cobaltocyanide, prepared by adding potassium cyanide solution to a well boiled solution of cobalt sulphate, is simply boiled, hydrogen is evolved, the volume of which is equal to that of the oxygen absorbed during the rapid oxidation by air, and is chemically equivalent to the oxygen required according to the foregoing equation.

Solutions of chromous salts also evolve hydrogen when they are boiled or treated with platinised platinum, but no hydrogen peroxide is formed during their oxidation by atmospheric oxygen, and the amount of oxygen absorbed is simply that required for the oxidation.

The author therefore regards the oxidation of the chromous salts as due to the direct action of the oxygen of the air, whilst that of potassium cobaltocyanide is a spontaneous oxidation effected by the oxygen of the water present, the function of the absorbed oxygen being to unite with the liberated hydrogen, and thus destroy the equilibrium which normally exists between the cobaltocyanide, hydrogen, and cobaltocyanide.

A. H.

Ammonium Chromous Sulphate. By CHARLES LAURENT (*Compt. rend.*, 1900, 131, 111—113).—*Ammonium chromous sulphate*, $(\text{NH}_4)_2\text{Cr}(\text{SO}_4)_2 + 6\text{H}_2\text{O}$, prepared by concentrating in an atmosphere of carbon dioxide an aqueous solution of ammonium and chromous sulphates in molecular proportion, forms large, blue crystals resembling those of the double sulphates of the magnesium series. It is insoluble in alcohol, but readily soluble in water; 100 c.c. of the saturated aqueous solution at 20° contain 55 grams of the salt. When exposed to air, it is rapidly oxidised and converted into chromic salt.

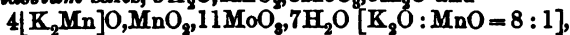
N. L.

Permanganomolybdates. By CARL FRIEDHEIM and MINNA SAMELSON (*Zeit. anorg. Chem.*, 1900, 24, 65—107).—The authors have repeated the work of Rosenheim and Itzig (*Abstr.*, 1898, [ii, 154], Struve (*J. pr. Chem.*, 1854, 61, 449), and Péchard (*Abstr.*, 1897, ii, 498), and have prepared the following compounds.

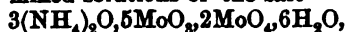
Ammonium permanganomolybdate, $3(\text{NH}_4)_2\text{O} \cdot \text{MnO}_2 \cdot 9\text{MoO}_3 \cdot 7\text{H}_2\text{O}$, is obtained by adding 1.8 litres of a concentrated solution of ammonium paramolybdate (1 litre = 250 grams) to 100 c.c. of a solution of manganous chloride (1 litre = 875 grams) and then 800 c.c. of 2.5 per cent. hydrogen peroxide; the mixture is boiled for some time and filtered, when on cooling the salt separates in small, lustrous, red rhombohedra. It is necessary to employ solutions of the above strength, for under other conditions different salts are formed. The isomorphous mixture $4[(\text{NH}_4)_2\text{Mn}]_2\text{O} \cdot \text{MnO}_2 \cdot 11\text{MoO}_3 \cdot 8\text{H}_2\text{O}$ $[(\text{NH}_4)_2\text{O} : \text{MnO} = 8 : 1]$ is obtained by employing 20 per cent. more of a 3 per cent. solution of hydrogen peroxide in the above reaction. The salt, $2(\text{NH}_4)_2\text{O} \cdot \text{MnO}_2 \cdot 7\text{MoO}_3 \cdot 5\text{H}_2\text{O}$, is obtained by employing 18.5 per cent. solution of hydrogen peroxide in the above reaction.

The isomorphous mixture $4[(\text{NH}_4)_2\text{Mn}]_2\text{O} \cdot \text{MnO}_2 \cdot 10\text{MoO}_3 \cdot 6\text{H}_2\text{O}$ $[(\text{NH}_4)_2\text{O} : \text{MnO} = 17 : 3]$ is obtained by boiling a solution of the salt $3(\text{NH}_4)_2\text{O} \cdot 5\text{MoO}_3 \cdot 2\text{MoO}_4 \cdot 6\text{H}_2\text{O}$ with the equivalent quantity of manganous chloride. It crystallises in lustrous, red rhombohedra.

The *potassium salts*, $3\text{K}_2\text{O} \cdot \text{MnO}_2 \cdot 8\text{MoO}_3 \cdot 3\text{H}_2\text{O}$ and



are obtained in a similar manner by the action of hydrogen peroxide on mixed solutions of potassium paramolybdate and manganous chloride. *Potassium permanganomolybdate*, $3\text{K}_2\text{O} \cdot \text{MnO}_2 \cdot 9\text{MoO}_3 \cdot 5\text{H}_2\text{O}$, corresponding with the above ammonium salt, is obtained by adding a saturated solution of potassium chloride to the corresponding ammonium salt, or the salt $4(\text{NH}_4)_2\text{O} \cdot \text{MnO}_2 \cdot 10\text{MoO}_3 \cdot 6\text{H}_2\text{O}$. The isomorphous mixture $3[\text{K}_2(\text{NH}_4)_2]\text{O} \cdot \text{MnO}_2 \cdot 8\text{MoO}_3 \cdot 4\text{H}_2\text{O}$ $[\text{K}_2\text{O} : (\text{NH}_4)_2\text{O} = 4 : 1]$ is obtained by boiling mixed solutions of the salt



manganous chloride, and potassium chloride, and is a microcrystalline, orange-red powder.

A repetition of Struve's work resulted in the preparation of the following new salts. *Potassium manganese permanganomolybdate*, $2K_2O, MnO, MnO_2, 9MoO_3, 8H_2O$, is obtained by treating a solution of potassium trimolybdate and manganous sulphate with chlorine. *Ammonium permanganomolybdate*, $4(NH_4)_2O, MnO_2, 11MoO_3, 7H_2O$, is obtained in small quantities by prolonged boiling of pure hydrated manganese dioxide with a solution of ammonium paramolybdate. The salt, $3(NH_4)_2O, MnO_2, 9MoO_3, 8H_2O$, is obtained when hydrated manganese dioxide containing manganous oxide is employed in the preparation of the preceding salt.

A repetition of Péchard's and Rosenheim and Itzig's work resulted in the preparation of the following salts. The isomorphous mixture $3[K_2(NH_4)_2Mn]O, MnO_2, 10MoO_3, 6H_2O$ [$K_2 : (NH_4)_2 : Mn = 2 : 20 : 5$] is obtained by the action of potassium permanganate on a mixture of ammonium paramolybdate and manganous chloride, and crystallises in lustrous, red rhombohedra. The mixture,

$3[(NH_4)_2Mn]O, MnO_2, 10MoO_3, 10H_2O$ [$(NH_4)_2 : Mn = 10 : 3$], obtained by the action of potassium permanganate on ammonium manganese molybdate, crystallises in beautiful, red rhombohedra. If the crystallisation of the preceding mixture is effected rapidly, it contains potassium salt in the proportion $(NH_4)_2 : K : Mn = 12 : 1 : 1$. The isomorphous mixture $4[K_2(NH_4)_2Mn]O, MnO_2, 10MoO_3, 5H_2O$ [$(NH_4)_2 : K_2 : Mn = 20 : 5 : 1$] is obtained by reducing a boiling solution of potassium permanganate and ammonium molybdate with alcohol until the violet colour is changed to red. When excess of ammonium molybdate is employed, the salt $3[(NH_4)_2Mn]O, MnO_2, 10MoO_3, 8H_2O$ [$(NH_4)_2 : Mn = 20 : 1$] is formed.

The salts described above form a new series of compounds as shown by the formula $2R_2O, MnO_2, 7MoO_3$; $3R_2O, MnO_2, 8MoO_3$; $3R_2O, MnO_2, 9MoO_3$; $3R_2O, MnO_2, 10MoO_3$; $4R_2O, MnO_2, 10MoO_3$; $4R_2O, MnO_2, 11MoO_3$.
E. C. R.

Reduction of Tungsten Trioxide by Zinc. Preparation of Pure Tungsten. By MARCEL DELÉPINE (*Compt. rend.*, 1900, 131, 184—187. Compare this vol., ii, 8).—Tungsten is readily prepared by heating a mixture of tungsten trioxide or ammonium tungstate with powdered zinc in a gas or coke furnace. A product containing 94 per cent. of the element may be obtained from commercial zinc and crude tungsten trioxide, and the percentage is raised to 99.9 by extracting the substance with sodium hydroxide solution and drying the residue at red heat in a current of hydrogen. The metal is produced by this process in the form of a grey, crystalline powder which assumes a metallic lustre on compression or trituration; its density is 18.64, corresponding closely with the value obtained for the massive form. The heat of combustion of the metal to the trioxide is 196.44 Cal. at constant vol. and 197.3 Cal. at constant pressure; the heats of oxidation of WO_3 to WO_2 and W to WO_2 at constant pressure are 64.9 and 132.4 Cals. respectively.

Tungsten trioxide may be readily reduced by hydrogen at temperatures below the fusing point of glass. G. T. M.

Crystallisation of Gold. By ALFRED DITTE (*Compt. rend.*, 1900, 131, 143—149).—When a sheet of gold is heated for several hours in contact with a mixture of sodium chloride and sodium pyrosulphate, the surface of the metal becomes eroded by the action of the pyrosulphuryl chloride produced, and the gold chloride which results subsequently dissociates, leaving this element in a crystalline form. The same result is obtained by employing a mixture of ferrous sulphate and sodium chloride, and although the temperature attained is below the melting point of gold, the metal produced from the chloride is found in the form of rhombic plates, small prisms, six-rayed rosettes, and fern-like aggregates; a portion is also obtained in non-crystalline filaments indicating incipient fusion. These appearances resemble those presented by the gold of auriferous minerals. When quartz fragments are introduced with the mixtures employed in the preceding experiments, it is found that the gold crystals and filaments are deposited at the surface and in the fissures of the mineral.

The aqueous extract of the salts after fusion contains sodium sulphide, produced by the action of the oxides of sulphur on the fused sodium chloride; when the oxides of iron or other metals are present, the corresponding sulphides are produced by double decomposition. These reactions are comparable with those occurring in nature and explain the presence of the sulphides in auriferous quartz.

A mixture of sodium chloride and pyrosulphate attacks platinum in a similar manner, the fused mass containing detached particles of the metal and traces of its chlorides. G. T. M.

Gold-Aluminium Alloys. By CHARLES T. HEYCOCK and FRANCIS H. NEVILLE (*Phil. Trans.*, 1900, A., 194, 201—232).—Addition of aluminium to gold lowers the freezing point of the latter metal, and an alloy containing 21.5 atomic per cent. of aluminium freezes as low as 525°. Further addition of aluminium raises the freezing point until a maximum is reached at 625°, corresponding with an alloy of the composition Au_2Al . The freezing point curve then falls again, reaching another minimum or eutectic point at about 570°, corresponding with 40 atomic per cent. of aluminium. From that point, the curve rises rapidly to 1060°, the freezing point of the alloy AuAl_3 , the purple compound discovered by Sir W. Roberts-Austen. After passing this maximum, the curve falls again and has a minimum close to the freezing point of pure aluminium. This curve, on which a large number of points have been determined, shows the existence of the compounds Au_2Al and AuAl_3 , whilst other singularities, less well marked than those mentioned, point to the formation at various stages of less stable compounds, probably Au_4Al , Au_5Al_2 (or Au_8Al_3), and AuAl . As the curve is followed, the different substances that crystallise out may be traced in the changing colour of the alloys, which are at first yellow, owing to the presence of free gold, then white, then purple, and finally white again as the aluminium end of the curve is reached.

These results are fully borne out by a microscopic study of the
VOL. LXXVIII. ii.

alloys. In particular, the alloys which are approximately of the composition Au_2Al and AuAl_2 show the structure which is characteristic of a nearly pure substance; polygonal sections of the crystals cover the surface, divided only by fine boundary lines; as the composition of the alloy departs from that of the pure compound, so these boundary lines increase in size. The results given by slowly cooled alloys are the same in kind as those obtained from quickly cooled alloys. A number of photomicrographs illustrate this part of the paper.

J. C. P.

Mineralogical Chemistry.

Ankerite from Missouri. By AUSTIN F. ROGERS (*Kansas Univ. Quart.*, 1899, 8, A, 183).—The material analysed consists of salmon coloured, crystalline masses, with minute crystals lining crevices; it occurs with hematite, chalybite, calcite, and amethyst, near Rolla, Phelps Co. The formula agrees closely with that for normal ankerite, namely, $2\text{CaCO}_3, \text{MgCO}_3, \text{FeCO}_3$:

CaO.	MgO.	FeO.	CO ₂ .	Total.	Sp. gr.
28.41	10.20	17.22	44.21	100.04	2.99
					L. J. S.

Origin of Nitrates in Cavern Earths. By WILLIAM H. HESS (*J. Geol.*, 1900, 8, 129—134. Compare Abstr., 1896, ii, 529).—The considerable deposits of nitrates in the great limestone caves of Virginia, Kentucky, and Indiana are often supposed to have been formed by bats; but this, it is pointed out, is probably incorrect. The author supposes that the nitrates in the surface soil have been carried by percolating water (surface drainage) into the caves below, where, in cases in which evaporation exceeds inflow, the nitrates are deposited. In support of this theory are given analyses of cave earth, bat guano, and of the water which drips from the roof of the Mammoth Cave, Kentucky. The same explanation would also apply to the deposits of nitrates found under rock ledges.

L. J. S.

Composition of Sulphohalite. By SAMUEL L. PENFIELD (*Amer. J. Sci.*, 1900, [iv], 9, 425—428).—From the single partial analysis that has been made of sulphohalite, the formula was deduced as $3\text{Na}_2\text{SO}_4, 2\text{NaCl}$ (Abstr., 1889, 217). Recent attempts by de Schulten and by van't Hoff and Saunders to prepare this compound artificially have failed, and the existence of sulphohalite has consequently been doubted; a new analysis was therefore desirable. The following are the new results obtained with carefully purified material from a portion of the same optically isotropic, rhombic dodecahedral crystal used for the previous analysis:

SO ₃ .	Na ₂ O.	K ₂ O.	Na.	Cl.	F.	Ignition.	Total.	Sp. gr.
41.79	32.37	0.10	11.60	9.10	4.71	0.15	99.82	2.500

This gives the formula $2\text{Na}_2\text{SO}_4, \text{NaCl}, \text{NaF}$. The presence of fluorine is unexpected, but may be explained by the borax deposits of Borax Lake, San Bernardino Co., California, having been formed by fumerole action. Sulphohalite is intimately associated with hanksite, a mineral also containing three acid constituents, $9\text{Na}_2\text{SO}_4, 2\text{Na}_2\text{CO}_3, \text{KCl}$, (Abstr., 1897, ii, 49).
L. J. S.

Melilite Group of Minerals. By FERDINAND FOUQUÉ (*Bull. Soc. franç. Min.*, 1900, 23, 10—15).—In the analysis of silicate rocks by Deville's method, in which the material is fused with lime, it is found that the fused mass on cooling sometimes consists almost entirely of a crystalline mass of a mineral of the melilite group. Thin sections under the microscope show tetragonal crystals which are sometimes arranged in spherulitic groups 1 mm. in diameter; the crystals are always optically positive with marked birefringence, but are often nearly isotropic in the centre. Analyses I and II are of the products obtained by fusing an andesite and a basalt respectively with about an equal amount of calcium carbonate.

	TiO ₂	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	Na ₂ O	K ₂ O	Total	Sp. gr.
I.	0.23	36.47	18.00	2.22	2.98	42.18	0.89	2.44	0.46	100.82	2.95
II.	0.56	32.55	12.49	1.48	4.67	42.08	8.86	2.35	0.63	100.62	2.99

Vogt has considered the members of the melilite group to consist of mixtures of the two end members gehlenite and the non-aluminous åkermanite, which are optically negative and positive respectively. According to this theory, a member with 12 per cent. of alumina should be optically negative and almost isotropic, but this is opposed to the present observations.
L. J. S.

Gadolinite from Batum. By G. P. TOCHERNIK (*J. Russ. Phys. Chem. Soc.*, 1900, 32, 252—266).—Gadolinite occurring in the form of a cement occurs with flesh-red feldspar in a coarse-grained granite from the bed of the river Chorok. The mineral, which has a hardness slightly less than 7 and a sp. gr. 4.205, shows no cleavage, the fracture being conchoidal. It has a dark resinous-black colour with a distinct greenish shade and a fatty lustre, and is opaque even at the edges of very thin fragments; from external examination, it appears to be amorphous. It does not melt in the blowpipe flame, but readily breaks up and increases slightly in volume; on cooling, it becomes greyish-green in colour. Concentrated hydrochloric acid and aqua regia readily attack, but do not completely decompose it, whilst sulphuric acid acts less energetically. Analysis:

Y ₂ O ₃	Er ₂ O ₃	CaO	FeO	BaO	Nb ₂ O ₅	TiO ₂	CaO
28.38	11.01	0.53	10.02	4.22	1.05	5.08	4.92
		LaO	DiO	SiO ₂	H ₂ O	Total	
		4.86	4.99	22.20	0.73	98.87	

with traces of MgO, MnO, Al₂O₃, K₂O, Na₂O and P₂O₅. The Nb₂O₅, which is probably due to the presence of some other mineral, possibly contains small quantities of Ta₂O₅.
T. H. P.

Manganocalcite and Angolite. By EDUARD BREUSING (*Inaug. Diss. and Jahrb. Min.*, 1900, Beil.-Bd., 13, 265—330).—Mangano-

calcite from Schemnitz, Hungary, was described by Breithaupt as an orthorhombic carbonate of manganese, calcium, &c., belonging to the aragonite group. It was afterwards shown by Des Cloiseaux (Abstr., 1886, 320) to be a mixture of carbonate and an anorthic hydrated silicate of manganese, and this is confirmed by the present author, who gives the name angolite (angolith) to the latter. The angolite can only be separated from the mixture by mechanical means, since it is readily decomposed by acids; it is flesh-red to rose-coloured, with a vitreous lustre; $H = 5$; sp. gr. 3.054—3.067; there is a cleavage parallel to the length of the fibres, and the pure material contains no carbon dioxide, calcium or magnesium. The mixture occurs in globular aggregations with a radial structure, and it varies considerably in composition; the mean of several analyses is given under I. After deducting a variable amount of carbonates (14.90 per cent. in the mean), the composition (II) of the angolite agrees with the formula $H_2Mn_3(SiO_3)_4, H_2O$. Angolite is a zeolite related to apophyllite or heulandite, and perhaps to inesite.

	SiO ₂	FeO.	MnO.	CaO.	MgO.	CO ₂	H ₂ O.	Total.
I. 41.89		1.23	35.79	7.51	0.90	6.49	6.30	100.11
II. 49.21		43.39		—	—	—	7.40	100.00

L. J. S.

Corundum-bearing Rocks of Eastern Ontario. By WILLER G. MILLER (*Amer. Geologist*, 1899, 24, 276—282).—Corundum occurs in Eastern Ontario in syenites, syenite-pegmatites, nephelite-syenites, and anorthosites, which as large masses are intrusive in the gneiss of the region; these occurrences are similar to those of India and the Urals (Abstr., 1899, ii, 763). A specimen of the anorthosite free from corundum from South Sherbrooke gave analysis I (by W. Lawson); the felspar (bytownite, Ab, An₄) from the same rock gave II, and the hornblende gave III (in III also a trace of MnO).

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	CaO.	MgO.	Na ₂ O.	K ₂ O.	CO ₂	H ₂ O.	Total.	Sp. gr.
I.	47.32	30.36	1.35	1.55	15.45	2.44	1.88	0.66	0.58	0.10	101.69	2.73
II.	48.12	34.54	0.86	—	16.30	trace	1.91	0.15	—	nil	101.38	2.731
III.	41.40	15.39	7.01	7.17	12.53	10.31	3.58	1.56	—	0.81	99.76	3.13

L. J. S.

Meteorite from Oakley, Kansas. By H. L. PRESTON (*Amer. J. Sci.*, 1900, [iv], 9, 410—412).—This stone, which weighs 27.9 kilograms, was found 15 miles south-west of Oakley, Logan Co., Kansas, in 1895. The material is greyish-black with darker blotches and numerous grains of metallic iron and troilite. Under the microscope, it shows condrioles of olivine and enstatite set in a very irregularly granular ground-mass of the same materials. Sp. gr. 3.7. The metallic portion (14.44 per cent. of the whole) contains Fe, 89.16; Ni, 10.84 per cent.

A list is given of eleven meteorites reported from Kansas, and it is suggested that five of these belong to the same fall. L. J. S.

Analyses of French Mineral Waters. By ADOLPHE CARNOT (*Ann. des Mines*, 1899, [ix], 16, 33—94).—A collection is given of 122 analyses of mineral waters from France and her colonies which

have been performed since 1894 in the Laboratory of the National School of Mines. Previous collections of 255 and 207 analyses were published in 1884 and 1894 respectively.

L. J. S.

Physiological Chemistry.

Digestion in Birds. By L. PAIRA-MALL (*Pflüger's Archiv*, 1900, 80, 600—627).—In pigeons and hens, during hunger, the gastric cells are laden with granules of ferment or zymogen. These granules are believed to be converted into the enzyme by the acid formed. The amount of pepsin obtainable from the mucous membrane continuously diminishes during digestion, reaching its minimum 6 to 8 hours after the meal. Restoration begins 2 or 3 hours later. The gizzard does not form pepsin. The gullet and crop secrete only mucus. The so-called middle-stomach of crows and magpies forms pepsin in the same way as described above. The histological changes in the cells of the pancreas are similar to those described by Heidenhain in the dog. This gland forms both proteolytic and amylolytic enzymes.

W. D. H.

Peptic Digestion. By EMIL SCHÜTZ and KARL H. HUPPERT (*Pflüger's Archiv*, 1900, 80, 470—526).—The experiments were conducted with egg-albumin freed from globulin; ovo-mucoid is not affected by gastric digestion, or may be removed by boiling with neutral ferric acetate. Determinations, mainly by the polarimeter, were made after digestion with artificial gastric juice of (1) acid-albumin, (2) primary proteoses, (3) secondary proteoses. The results are given in tables, and show the influence of temperature, of the degree of acidity, of the amount of albumin originally taken, of the length of time of digestion, of the volume of the fluid, and of the amount of pepsin on the relative quantities of the three groups of products just mentioned.

W. D. H.

The Bile as a Digestive Juice. By G. G. BRUNO (*Chem. Centr.*, 1900, i, 916; from *Arch. Sci. biol. St. Petersburg*, 7, 87—142).—The flow of bile ceases when the stomach is empty; it begins to flow with the entrance of food into the stomach. Water, proteid, or carbohydrate does not intensify the rate of secretion, but fat does.

The bile contains a proteolytic and a fat-splitting enzyme. It also assists the pancreatic juice in all its activities.

W. D. H.

Secretion of the Pancreas. By A. A. WALTER (*Chem. Centr.*, 1900, i, 916; from *Arch. Sci. biol. St. Petersburg*, 7, 1—86).—The secretion of pancreatic juice in dogs is stimulated by the hydrochloric acid of the stomach, and this largely depends on the appetite of the animal. The amount of secretion runs parallel with the amount of water in the food. Food rich in proteid, carbohydrate and fat calls forth respectively an increase of trypsin, amylpsin, and steapsin.

High acidity of the gastric is accompanied by high alkalinity of the pancreatic juice. The signal for all these reflex effects is the stimulation of the nerve-endings of the intestinal mucous membrane.

W. D. H.

Metabolism in Horses. By THEODOR PFEIFFER (*Landw. Versuchs-Stat.*, 1900, 54, 101—112. Compare *J. Landw.*, 1890, 38, 258).—A criticism of Zuntz and Lehmann's methods and conclusions (*Abstr.*, 1889, 911; *Landw. Versuchs-Stat.*, 1891, 38, 340; and *Landw. Jahrb.*, 1894, 23, 125, and 1898, 27, *Ergänzungsbd.*, iii). Respiration experiments during short periods furnish data as regards the direction of metabolism under different conditions, but cannot show exactly the absolute extent of the effects of the feeding.

N. H. J. M.

Influence of Extract of Ovaries on the Changes Produced in Nutrition During Pregnancy. By ALBERT CHARRIN and GUILLEMONAT (*Compt. rend.*, 1900, 130, 1787—1789).—During pregnancy, the activity of the organs of nutrition is notably diminished, less oxygen being consumed, and smaller quantities of carbon dioxide and urea eliminated. Injections of extracts of liver, spleen, and muscle do not stimulate these organs to any appreciable extent, whereas the extract of one or two ovaries, obtained by digesting these glands with a dilute solution of glycerol and sodium chloride, has a marked effect in increasing the excretion of urea. This result can only be maintained, however, by repeating the injection at least once in three days.

G. T. M.

Action of Increased Osmotic Pressure on the Ovum. By E. BATAILLON (*Compt. rend.*, 1900, 130, 1480—1482).—By placing the egg-cells of *Petromyzon* in isotonic solutions of salt or sugar, the separation of the blastosphere into its early segmentation spheres is accelerated, and may even result in a complete division, and formation of two embryos. Similar mechanical processes may possibly explain the occurrence of double monsters, or other abnormalities, in the higher animals.

W. D. H.

Relationship between the Nitrogen and Chlorides of the Stomach-contents. By JUSTIN WINTER and FALLOISE (*Compt. rend.*, 1900, 130, 1646—1648).—Attention is drawn to a fixed relationship which exists between the chlorine of the gastric juice and the amount of nitrogenous substances which pass into solution. This ratio is expressed by a mathematical formula.

W. D. H.

Thiocyanate in Human Saliva. By LAFAYETTE B. MENDEL and E. C. SCHNEIDER (*Proc. Amer. Physiol. Soc.*, 1900, vii—viii; *Amer. J. Physiol.*, 4).—The saliva of non-smokers and smokers shows an average of 0.0029 and 0.0134 of potassium thiocyanate per cent. respectively. The parotid saliva is uniformly richer in this substance than the submaxillary saliva.

W. D. H.

Action of Anti-leucocytic Serums on Blood-coagulation. By O. DELEZENNE (*Compt. rend.*, 1900, 130, 1488—1490. Compare this vol., ii, 423).—Further experiments are brought forward to show that certain serums like 'peptone' when injected intra-

venously lead to the liberation of an anti-coagulating substance. The importance of the liver as well as of the leucocytes is insisted on. Probably, when the leucocytes disintegrate, two substances are liberated, one assisting, the other hindering, coagulation of the blood; the former is retained by the liver, the latter remains in the blood.

W. D. H.

Iodine in the Blood. By EUGÈNE GLEY and PAUL BOUBOET (*Compt. rend.*, 1900, 130, 1721—1724).—In the blood of the dog, iodine combined with nucleo-proteid is present normally in solution. Its amount, like that of iodine in the thyroid, is variable. In the analyses quoted, the amount of iodine in the thyroid varied from 0.18 to 1.06, and in a litre of blood from 0.013 to 0.11 milligram.

W. D. H.

Artificial Production of Normal Larvæ from Unfertilised Eggs of the Sea Urchin. By JACQUES LOEB (*Amer. J. Physiol.*, 1900, 3, 434—471).—The paper describes in full a large number of experiments which show that the eggs of the sea urchin will develop with somewhat imperfect embryos even though fertilisation has not occurred. To promote this, 'physiologically balanced salt solutions' were used similar to those employed previously in the study of muscular contraction and other vital contractile phenomena.

W. D. H.

Organic Substance of the Shells of *Mytilus* and *Pinna*. By G. WETZEL (*Zeit. physiol. Chem.*, 1900, 29, 386—410).—The organic basis of the shells of *Mytilus* and *Pinna* is mainly conchiolin. On being decomposed by sulphuric acid, it yields tyrosine, leucine, and glycine. The occurrence of phenylaminopropionic acid or other phenyl-amino-acids is not probable. It contains also a 'hexon' nucleus; the yield of bases places it between casein and egg-albumin. The quantity of nitrogen split off as ammonia amounts to 3.47 per cent. of the whole. The organic residue of the mother-of-pearl substance of the mussel shell differs from that obtained from the rest of the shell by a smaller percentage of carbon.

W. D. H.

Mucin. By ISAAC LEVIN (*Amer. J. Physiol.*, 1900, 4, 90—95).—Mucin prepared from connective tissue, when injected into the blood-stream of dogs and rabbits, produces a depressive effect on the central nervous system, which is chiefly shown by a fall of blood-pressure. It is, however, not fatal unless the animal has been previously deprived of its thyroid. Mucinæmia may be one of the pathological conditions resulting from the absence of the thyroid function.

W. D. H.

Chemistry of Paranucleo-compounds. By P. A. LEVENE and C. L. ALSBERG (*Proc. Amer. Physiol. Soc.*, 1900, xi; *Amer. J. Physiol.*, 4).—The ichthulin of the cod-fish egg differs from that described by Walter in its percentage composition and in containing no carbohydrate radicle in its molecule. On treatment with alkalis, both ovo-vitellin and ichthulin yield substances akin to true nucleic acids, but differing from them in the absence of purine bases, and in containing proteid in their molecule. This proteid does not resemble the protamines, as can be concluded by the yield of 'hexon' bases. Iron

enters into the molecule of the paranucleins in a combination probably similar to that of the ethereal acids. W. D. H.

Chemistry of the Lymphatic Glands. By LAFAYETTE B. MENDEL and R. NAKASEKO (*Proc. Amer. Physiol. Soc.*, 1900, xii; *Amer. J. Physiol.*, 4).—In view of a possible compensatory action of the lymphatic glands after splenectomy (an operation which does not lessen uric acid excretion), the Horbaczewski-Spitzer experiments were repeated with these organs. At most, only traces of uric acid were obtained by treatment of 100—300 grams of material. Xanthine bases were found in larger quantity. The glands are rich in nucleic acid, the study of which is being continued. W. D. H.

Urea in Human Milk. By BERNHARD SCHÖNDORFF (*Pflüger's Archiv*, 1900, 81, 42—47).—Polemical. The values for urea in human milk given previously are maintained to be correct, and those given by Camerer and Söldner incorrect, and much too small W. D. H.

Xanthine Bases in Fæces. By WILLIAM H. PARKER (*Amer. J. Physiol.*, 1900, 4, 83—89).—From experiments on man, it is found that under normal conditions on a diet containing no nuclein there is a constant excretion of combined xanthine bases derived from the cells of the alimentary canal. The amount excreted is about 30 milligrams a day, and is about equal to that which leaves the body by the urine under the same conditions. The amount is nearly doubled with a mixed diet. This increase may not be necessarily due to the nuclein and alloxuric substances in the food, but may arise indirectly from an influence exerted on the processes of metabolism and secretion. W. D. H.

Excretion of Sulphur after Extirpation of the Liver. By S. LANG (*Zeit. physiol. Chem.*, 1900, 29, 305—319).—After the extirpation of the liver in birds, the amount and relationships of the various forms of sulphur in the urine show no noteworthy departure from the normal. The liver plays practically no part in the formation of sulphuric acid from the sulphur of the food. W. D. H.

Albumin in Normal Urine. By A. BELLOCQ (*J. Pharm.*, 1900, [vi], 11, 478—482).—After carefully defining what shall be considered as "normal" urine, the author states that the latter produces a faint turbidity with Tanret's iodo-mercuric reagent in presence of a saturated solution of citric acid. This turbidity, although almost unnoticeable alone, is distinctly visible when compared with the original limpid urine. Finely-divided manganese dioxide carries down from normal urine the whole of its albumin, the latter being recovered as a whitish mucilage; on dissolving the dioxide in a saturated solution of sulphurous acid, adding 30 per cent. of alcohol of 85° containing citric acid, and filtering, ordinary albumin contaminated with uric acid is obtained. W. A. D.

Decrease of Water in the Central Nervous System of the Growing White Rat. By HENRY H. DONALDSON (*Proc. Amer. Physiol. Soc.*, 1900, v—vi; *Amer. J. Physiol.*, 4).—In the spinal cord of rats,

the percentage of water decreases from 85 at birth to 70 in old age; in the brain the numbers respectively are 88 and 77.5. The most rapid stage of loss of water is from the tenth to the fiftieth day of life, the period during which the process of myelination of the nerve fibres is proceeding most rapidly.

W. D. H.

Physiological Action of Extracts of Sympathetic Ganglia. By ALLEN CLEGHORN (*J. Boston Soc. Med. Sciences*, 1900, 4, 239—242. Compare Abstr., 1899, ii, 569, and this vol., ii, 423).—The idea that choline is the substance responsible for the fall of blood-pressure produced by the injection of extracts of sympathetic ganglia is combated. The extracts in the present experiments were made with alcohol; this was evaporated off, and the residue dissolved in saline solution. Choline is admittedly present, but after the removal of choline by platinic chloride and filtering, the filtrate was evaporated to dryness, and the residue extracted with saline solution. Injection of this still produced a fall of blood-pressure. Moreover, it is stated that the depressor effect of the ganglionic extract is not abolished by atropine.

W. D. H.

The Anti-rennin of Serum in Pathological Conditions. By CH. ACHARD and A. CLERC (*Compt. rend.*, 1900, 130, 1727—1729).—Previous observers have shown that normal blood-serum contains some substance which hinders the action of rennin on milk. In the present research, thirty-four human serums from various cases of disease were examined, with the general result that the anti-rennin substance diminishes in grave pathological disorders.

W. D. H.

Analysis of the Liquid contained in a Mesenteric Cyst. By A. RICHAUD and R. BONNEAU (*J. Pharm.*, 1900, [vi], 11, 535—541).—The liquid had a sp. gr. 1.025, an alkaline reaction, and did not deposit fibrin after 18 hours; it contained 94.14 per cent. of water, 4.15 per cent. of proteid material (precipitated by alcohol acidified with acetic acid), 0.45 per cent. of fat, 0.77 per cent. of extractives, and gave a solid residue of 5.86 per cent., and 0.49 per cent. of ash. The ash contained sulphates, chlorides, and carbonates, but no phosphates. On adding an excess of alcohol of 95°, a viscous, fibrous mass of proteids was precipitated; this mass shared the character of both the true and the pseudo-mucins, since on heating with dilute sulphuric acid for 1 hour at 115—120° it yielded a substance having reducing properties (reaction of true mucin), and yet on peptic digestion gave an ash rich in phosphorus (characteristic of pseudo-mucin). Finally, it is noteworthy that the secretion contained only minute quantities of serin, globulin, or casein.

W. A. D.

Action of Diphtheria Toxin on the Motor Cells of the Spinal Cord. By H. RAINY (*J. Pathol. and Bacteriol.*, 1900, 6, 435—458).—Diphtheritic paralysis is associated, not only with changes in peripheral nerves, but also with alterations in the cord itself, namely, moderate chromatolysis and vacuolation of the protoplasm of the motor cells.

W. D. H.

Diphtheritic Paralysis and Antitoxin. By F. RANSOM (*J. Pathol. and Bacteriol.*, 1900, 6, 397—414).—Experiments on animals

show that with suitable doses, the administration of antitoxin prevents the development of paralysis caused by the diphtheritic toxin.

W. D. H.

The Lymph after Intravenous Injection of Tetanus Toxin and Antitoxin. By F. RANSOM (*Zeit. physiol. Chem.*, 1900, 29, 349—372).—After the injection of the tetanus poison into the bloodstream, an important part of it passes rapidly into the lymph, and after 26 hours, the amounts in blood and lymph are about equal. If the thoracic duct is opened before the injection of the toxin, so that the lymph drains away, the toxic value of the blood remains, for at least 6 hours, higher than that of the lymph. Much the same is true for the antitoxic horse-serum, except that even 68 hours after the injection the blood still contains more antitoxin than the lymph. The toxin thus behaves like an inorganic constituent, and the antitoxin like a proteid constituent of the blood-lymph system.

W. D. H.

Interaction of Toxin and Antitoxin. By WALTER MYERS (*J. Pathol. and Bacteriol.*, 1900, 3, 415—434).—In cobra venom there are two poisons, one, *cobralysin*, acts hæmolytically, the other, *cobranesurin*, causes death by its action on the respiratory centre. The present paper relates principally to the first, and to the methods by means of which it may be estimated physiologically, and the amount of antivenene necessary to neutralise it. Ehrlich's methods appear to have guided the experiments, and the formation of toxoids is confirmed. This combines with antitoxin, but does not act on the blood corpuscles.

W. D. H.

Use of Alkaline Solutions in Surgical Shock. By WILLIAM H. HOWELL (*Proc. Amer. Physiol. Soc.*, 1900, xiv—xv; *Amer. J. Physiol.*, 4).—Conditions of shock in animals produced, for instance, by operations on the brain, are associated with heart failure and fall of blood pressure. This can be largely counteracted by the injection of 0.5 per cent. solution of sodium carbonate into the veins or into the rectum. If injection is made into the veins, care must be taken to use a moderate amount of solution, not more than sufficient to raise the alkalinity of the blood by 0.1 to 0.2 per cent. Rectal injections are safer. 'Shock-blood' contains no poisonous substances.

W. D. H.

Action of Phloridzin on Muscle. By FREDERIC S. LEE and C. C. HARROLD (*Proc. Amer. Physiol. Soc.*, 1900, ix—x; *Amer. J. Physiol.*, 4).—One gram of phloridzin was injected three times daily for two to four days into fasting cats. The course of fatigue in the *tibialis anticus* muscle was then studied, when the animals were killed. Instead of giving 800 to 1000 contractions, it gives only 200 to 400, and the curves obtained resemble those obtained in the last stages of normal fatigue. This is due to removal of carbohydrates; subsequent injection of dextrose largely restores the muscle. Phloridzinised muscle rapidly goes into rigor.

W. D. H.

Influence of Phloridzin Diabetes on Lactation. By GRAHAM LUSK (*Proc. Amer. Physiol. Soc.*, 1900, xi; *Amer. J. Physiol.*, 4).—In fasting goats, phloridzin diabetes stops milk formation. This is

probably the result of the diabetes, and not of the specific action of phloridzin on the gland. In sugar elimination, the fasting goat resembles the rabbit, since in the urine the ratio of dextrose to nitrogen is 2.8 to 1.

W. D. H.

Toxicity of Urine. By ALBERT CHARRIN (*Compt. rend.*, 1900, 130, 1724—1726).—Support is given to Bouchard's views of auto-intoxication, and that the toxicity of urine is, at any rate in part, due to products of katabolism.

W. D. H.

Action on the Heart of Toxic Products of the Typhoid Bacillus. By GEORGE T. KEMP and MISS S. L. DEWEY (*Proc. Amer. Physiol. Soc.*, 1900, viii—ix; *Amer. J. Physiol.*, 4).—The culture medium used was alkali-albumin prepared from egg white *plus* Ringer's solution in the proportion 1 : 10. This has no action on the heart. The cultures of the typhoid bacillus were filtered, and tested on terrapins' hearts. The heart is gradually weakened without being slowed, and it finally stops in diastole. If the poison has not acted too long, the heart can be revived by Ringer's solution. This property is associated with the presence of proteid (albumin or globulin); the alcoholic filtrate, which is proteid-free, when evaporated to dryness and dissolved in Ringer's solution, increases the strength of the heart-beat without affecting the rate; the proteid precipitate, dissolved in the same solution, gives the same effect on the heart as the culture, but is somewhat less powerful.

W. D. H.

Combination of Nucleins with Metallic Compounds, Alkaloids, and Toxins. By H. STASSANO (*Compt. rend.*, 1900, 131, 72—74).—Ammonium hydrosulphide has no immediate action on mercury and arsenic contained in the nuclein derived from animals poisoned with compounds of these metals. The mercury may be eliminated by electrolysis, but less rapidly than from solutions of its salts, and the separation is accompanied by the destruction of the nuclein by the electric current. An aqueous solution of hæmatoxylin, which is rendered turbid by mercuric chloride dissolved in water or serum, remains unaltered in nuclein solutions containing mercury. These results indicate that the metallic radicles are actually in combination with the nuclein.

Morphine and strychnine can be rapidly extracted by ether from alkaline mixtures of the nucleins; the alkaloids are also liberated by electrolysis, the action being attended by the decomposition of the nuclein. The separation of nucleins from animal tissues by peptic digestion requires two days, whereas the nucleo-albumins can be isolated in one hour; the alkaloids may be eliminated from the latter substances quite as readily as from the former.

The nucleo-albumins prepared from the liver, spleen, and kidneys of dogs poisoned with ricin or tetanin are subjected to the action of a feeble electric current until the decomposition of the nuclein compounds is complete. The toxin and proteids are then precipitated together by alcohol, and from the precipitate the base is extracted with brine.

G. T. M.

Chemistry of Vegetable Physiology and Agriculture.

Mechanism of Agglutination. By HAROLD C. ERNST and W. H. ROBEY, jun. (*J. Boston Soc. Med. Sciences*, 1900, 4, 219—228).—A discussion with experimental tests of the numerous theories put forward to explain agglutination. No satisfactory theory to account for all cases has yet been offered, although Bordet's, that an agglutinating agent (agglutinine) acting upon an agglutinable substance of at present uncertain nature, is regarded as most rational. The reaction occurs, not only with bacteria, but with many other elements, globules, casein, and various precipitates.
W. D. H.

Antiseptic Value of Certain Chemicals in Milk. By S. MOULTON BABCOCK, H. L. RUSSELL, and ALFRED VIVIAN (*15th Ann. Rep. Agr. Expt. Stat. Univ. Wisconsin*, 1898, 98—103).—For the purpose of experiments on the enzymes of milk, it was desired to obtain an antiseptic which would act on the organised ferments without materially affecting the enzymes. Benzene, chloroform, ether, toluene, xylene, aniline, arsenious acid, thymene, phenol, sodium fluoride, oil of cloves, oil of cassia, oil of Ceylon cinnamon, oil of mustard, and turpentine were the substances tried.

It was found that the antiseptic efficiency of many substances is much less in milk than in liquids which do not contain substances like fat, which combines with the antiseptic and thus diminishes its power. Only four, chloroform, ether, benzene, and toluene, are to be recommended in studying the enzymes, and a distinction has to be made between curdling and the proteolytic action; ether retards curdling, whilst scarcely any difference exists in the time of curdling with the other three substances. Chloroform and ether seem to affect the digestive changes least. Chloroform is the best agent, and 2—3 per cent. keeps milk perfectly. Owing to its high sp. gr. and its affinity for fat, the cream is submerged, and this renders sampling more accurate.
N. H. J. M.

Boric Acid and Formaldehyde as Milk Preservatives. By SAMUEL RIDEAL and A. G. R. FOULERTON (*Exper. Stat. Record*, 1900, 11, 582; from *Public Health*, 1899, 11, 554—568).—The minimum amounts of the substances to preserve milk for 24 hours were found to be 1 in 50,000 for formaldehyde, and 0.05 per cent. of a mixture of boric acid and borax. These amounts have no appreciable effect on the proteolytic action of the peptic and pancreatic enzymes. The boric acid mixture distinctly retarded the amylolytic action of saliva, but it is doubtful if this is of importance; the action of formaldehyde was much less marked.

The results of experiments with kittens, a rabbit, and guinea-pigs indicated that the amount of formaldehyde required to preserve milk has no marked effect on proteid metabolism. Fishes were not appreciably affected by being kept for 6 days in water containing 1 part of

formaldehyde in 50,000, and a less dilute solution (1:20,000) did not seem to affect frogs in 2 hours.

The conclusions are drawn that the two substances, in the quantities as given, are effective preservatives for milk for 24 hours, and that they have no appreciable effect on the digestibility of the milk.

N. H. J. M.

Boric Acid and Formaldehyde as Food Preservatives. By OTTO HEHNER (*Exper. Stat. Record*, 1900, 11, 582—583; from *Brit. Food Jour.*, 1899, 1, 132).—The experiments of Rideal and Foulerton (preceding abstract) are criticised, on the ground that there were no control animals. The author is inclined to infer from the results that the preservatives, in the amounts recommended, are injurious.

N. H. J. M.

Action of Dry and Moist Air on Plants. By EBERHARDT (*Compt. rend.*, 1900, 131, 193—196).—Germinating plants develop more rapidly in air saturated with moisture than in dry or normal air; the stem is longer, but has a smaller diameter; the number of leaves is greater, but the production of rootlets is greatly diminished. Dry air decreases the development of the stem and leaves, the former, however, having a greater diameter than that of the plant grown under normal conditions; the foliage surface is diminished, whilst the number of rootlets is increased.

G. T. M

Can Strontium and Barium replace Calcium in Phænogams? By U. SUZUKI (*Bul. Coll. Agr. Tokyo Imp. Univ.*, 1900, 4, 69—79).—Sand culture experiments with buckwheat and barley, and water culture experiments with *Phlox paniculata*, *Rubus Idaeus*, and *Coreopsis tinctoria* are described. It was found that neither strontium nor barium can replace calcium, and that their salts are both strongly poisonous. Haselhoff's statement that strontium can replace calcium (*Abstr.*, 1894, ii, 207) is therefore incorrect.

The poisonous effects of barium and strontium are diminished by the presence of calcium.*

The author considers that Loew's view as to the rôle of calcium (*Abstr.*, 1899, ii, 789) agrees best with his observations.

N. H. J. M.

Distribution of Cane Sugar in Plants. By JUSTUS ANDERSEN (*Zeit. physiol. Chem.*, 1900, 29, 423—428).—The wide distribution of cane sugar in the vegetable world has been pointed out by Schulze. His investigations relate chiefly to the higher plants. The cryptogams still require to be investigated, and in the present paper it is shown that cane sugar is present in a number of ferns.

W. D. H.

Reserve Carbohydrate of the Seed of *Trifolium Repens*. By HENRI HÉRISSEY (*Compt. rend.*, 1900, 130, 1719—1721. Compare *Abstr.*, 1899, i, 839, and this vol., ii, 233).—The carbohydrate obtained from the seeds of *Trifolium repens* by extraction with cold water con-

* Haselhoff (*Abstr.*, 1896, ii, 267) found that very small amounts of barium are injurious, and suggested that addition of lime would lessen its effects.

taining lead acetate and precipitation of the filtered solution with alcohol, is a *mannogalactan*, for on hydrolysis with dilute sulphuric acid or seminase it yields galactose and mannose; a 1 per cent. solution gives $[\alpha]_D$ 81.1°.

G. T. M.

Composition of the Albumen of the Seed of the American Bean (*Gleditsia triacanthos*). By MAURICE GORET (*Compt. rend.*, 1900, 131, 60—63).—The albumen of the seed of the American bean (*Gleditsia triacanthos*) when hydrolysed at 110° with excess of 2 per cent. sulphuric acid yields 94.20 per cent. of reducing sugar; the soluble ferment seminase obtained from lucerne (Bourquelot and Hérissé, this vol., ii, 135, 233) has a similar hydrolytic action.

The reducing sugar contains about 70 per cent. of galactose and 23 per cent. of mannose; both constituents were isolated in a crystalline form, the former being estimated as mucic acid and the latter as mannose hydrazone.

It follows that this albumen is either a mannogalactan or a mixture of mannan and galactan (compare Abstr., 1899, i, 868, and ii, 301, 917).

G. T. M.

Arginine. By U. SUZUKI (*Bul. Coll. Agr. Tokyo Imp. Univ.*, 1900, 4, 1—24. Compare Schulze and Steiger, Abstr., 1886, 725; Schulze and Likiernik, *ibid.*, 1891, 1521; Hedin, *ibid.*, 1895, i, 160, and 1896, i, 193; Kossel, *ibid.*, 1896, i, 582; and 1898, i, 715; Schulze, *ibid.*, ii, 383 and 572; and 1898, ii, 179; Kutscher, *ibid.*, 1898, i, 161; Ellinger, *Ber.*, 31, 3183; and Gulewitsch, *Zeit. physiol. Chem.*, 27, 178).—The proteids obtained from the seeds of *Cryptomeria japonica*, *Pinus Thunbergii*, and *Ginkgo biloba* yielded much organic bases, chiefly arginine, when boiled with 20 per cent. hydrogen chloride (sp. gr. 1.10). The etiolated shoots of *Cryptomeria* and *Pinus* also contain much organic bases, chiefly arginine, but the shoots of *Ginkgo* yielded very little. It is probable that the chemical nature of the proteids of the shoots of coniferous plants is the same as that of the seed proteids, since both proteids furnish the same products of decomposition.

The method employed for the isolation of arginine is described.

N. H. J. M.

Formation of Arginine in Coniferous Plants. By U. SUZUKI (*Bul. Coll. Agr. Tokyo Imp. Univ.*, 1900, 4, 25—68. Compare E. Schulze, *Zeit. physiol. Chem.*, 22, 445).—The results of experiments with coniferous plants (*Pinus Thunbergii* and *Cryptomeria japonica*) showed that the arginine they contain is not only formed from the decomposition of proteids, but can be produced synthetically from ammonium salts and nitrates. This synthetical production of arginine takes place both in full and in diffused daylight, but it is not yet proved whether it proceeds in darkness.

There is a great accumulation of arginine in the shoots of coniferous plants in the dark, as well as in full daylight during the first stage of germination; it soon diminishes on further exposure to light, and gradually increases if the light is cut off. The transformation of arginine into proteids in presence of light is accelerated by the presence of mineral matter.

It is probable that arginine is directly used in regenerating proteids, but its relation to other amino-compounds requires further investigation. It seems, however, probable that there is a production of arginine from other amides.

From the results of experiments with *Brassica napa* and barley, the conclusion is drawn that in the case of plants other than coniferous, arginine is not formed from ammonium salts, asparagine being the only product.

N. H. J. M.

Amount of Alkaloids in the Bark of Java Pomegranates. By HEINRICH BECKURTS (*Arch. Pharm.*, 1900, 238, 8—9. Compare Ewers, *Abstr.*, 1899, ii, 457).—The percentage of alkaloids in bark from Java is found to be 0.92—0.98, that is, not much more than in the bark of roots from the South of France. In the titration of these alkaloids, iodeosin is to be preferred to methyl-orange as the indicator.

C. F. B.

[Composition of the Flowers of the] Hollyhock. By C. ZAY (*Landw. Versuchs-Stat.*, 1900, 54, 141—145).—The flowers of the hollyhock have the following percentage composition: Water, 13.15; crude fat, 2.29; crude fibre, 14.33; proteids, 6.56; nitrogenous matter other than proteids, 4.68; non-nitrogenous substances, 49.71; and ash, 9.28.

The flowers contain 0.67 per cent. of reducing sugar. The ethereal extract of the flowers yield a compound melting at 63.5—64°. It forms lustrous plates readily soluble in ether, petroleum, chloroform, or warm alcohol, and is not reddened by sulphuric acid.

N. H. J. M.

Composition of the Spores of *Aspergillus Oryzae*. By K. ASO (*Bul. Coll. Agr. Tokyo Imp. Univ.*, 1900, 4, 81—96).—The air-dried spores contained 57.485 per cent. of dry matter of the following percentage composition:

N.	Ether extract.	Alcohol extract.	Carbohydrates (as dextrose).	Crude fibre.	Ash.
6.380	0.377	27.666	20.017	8.994	5.151

Lecithin was detected in the ether extract, and the alcoholic extract which was obtained after extracting with ether was found to contain mannitol and trehalose.

The composition of the ash was found to be as follows:

K ₂ O.	Na ₂ O.	CaO.	MgO.	Fe ₂ O ₃ .	P ₂ O ₅ .	SO ₃ .	SiO ₂ .	Cl.
45.96	4.13	1.04	4.36	4.92	39.64	2.00	0.41	trace

N. H. J. M.

Metabolism in Full-grown Bullocks with Maintenance and Fattening Foods. By OSCAR KELLNER and A. KÖHLER (*Landw. Versuchs-Stat.*, 1900, 53, 1—16 and 398—474. Compare *Abstr.*, 1894, ii, 391, and *Landw. Versuchs-Stat.*, 1896, 47, 291 and 309).—In the experiments now described (see following abstracts), the effect of feeding with isolated foods, such as starch-meal, gluten-meal, oil, and cellulose, and of whole foods, as hay, cereal straw, and molasses, was determined by deducting the amounts of meat and fat produced

with a basal ration from the amounts obtained when the basal ration was employed in conjunction with the different foods.

Instead of adopting the usual method of calculating the results on 1000 lb. of live weight, the surface (compare Meek, *Zeits. Biol.*, 1879, 15, 425) of the beasts was taken into account, as it is on this that the losses of heat depend.

Among the factors which have to be taken into account in the experiments is the amount of water consumed. The raising of the temperature of the water to that of the body, and its elimination, cannot fail to be without influence. The amount of water consumed depends partly on the food; gluten-meal, molasses, hay, and straw increased, whilst starch-meal and oil diminished the consumption of water per kilogram of dry food.

As regards the production of hydrocarbons, 4.2 parts of methane were produced on the average from 100 parts of digested carbohydrate. Digestible protein and oil have no direct share in producing hydrocarbons; large amounts of oil hinder the production of hydrocarbons. The greatest quantity of hydrocarbon was obtained when wheat straw was employed. This is due, not only to the chemical composition of the straw, but to its physical nature and the fact that its digestion is slow.

Direct determinations of the heat of combustion of urine showed that, within certain limits of proteid-feeding, the amount of carbon in the urine is an approximately accurate measure of the heat value of the total dry matter of the urine, 1 gram of urine-carbon corresponding with about 10 Cal. With large amounts of gluten-meal, however, the carbon of the urine seems to be in compounds which yield more heat than was the case when the basal rations were employed alone. On the other hand, when the bullocks were fed with molasses, 1 gram of urine-carbon corresponded with less than 10 Cal., owing to the greater amounts of carbonates present.

By deducting the losses in urine and methane from the heat-value of 1 gram of digested organic matter, values are obtained indicating the amounts of heat produced by the decomposition of the digested substance in the organism, and also the relations in which the substances examined can replace each other in the maintenance food for bullocks. When starch is represented by 100, the following numbers show the isodynamic equivalents for the various foods: Earth-nut oil, 43; gluten protein, 76; extracted straw, 103; molasses, 103; hay, 103; oat straw, 100; and wheat straw, 113.

Owing to still greater losses than those due to formation of urine and methane, the values of the foods in producing flesh and fat are in every case below the "physiological values"—the heat value *minus* losses in urine and methane. The digestible organic matters of gluten-protein, starch, and molasses behave similarly, but the productive value of oil is decidedly higher, whilst in the case of hay and straw the values are lower than in the isolated components. The productive value of a substance depends therefore, not only on the amount of digestible matter it contains, but to an important extent on the nature of the tissues and on the amount of indigestible matter present.

Calculations of the amounts of digestible organic matter required to produce the same amounts of flesh and fat, over the minimum amounts required by the beasts, gave the following results: Starch meal, 100; gluten meal, 99; earth-nut oil, 45; extracted straw, 96; molasses, 97; hay, 147; oat straw, 157; and wheat straw, 374.

With full-grown bullocks, fattening rations with wide nutritive ratios can produce the same results as rations richer in proteids.

N. H. J. M.

Experiments with Gluten and Starch Meal. By OSCAR KELLNER, A. KÖHLER, F. BARNSTEIN, W. ZIELSTORFF, H. LÜHBIG, and F. MACH (*Landw. Versuchs-Stat.*, 1900, 53, 17—95).—In these experiments, which extended over some months, the amounts of food and water consumed, the changes in live weight, the amount and composition of the faeces and urine, and the amounts of carbon dioxide and hydrocarbon produced were determined; daily observations of the temperature of the stalls were also made.

When the amount of starch was increased so as to give a nutritive ratio of 1:15.95 or 1:16.21, considerable amounts of starch passed into the faeces, and the digestion of crude fibre was diminished.

Three concordant results showed that 86 per cent. of the crude proteid of gluten meal is digested.

In all the experiments, there was considerable production of hydrocarbon.

The production of fat by no means depends on proteid-feeding. Nitrogenous food produces for some time a greater increase of flesh than food poor in nitrogen, but the production of meat is not in proportion to the amount of digestible nitrogen in the food. Taking the average of both experiments, 1 kilogram of total food produced 219.7, 217.1, and 224.2 grams of flesh and fat when the nutritive ratios were 1:4, 1:10—11, and 1:16 respectively. The average amounts of increase produced by 1 kilogram of digestible food available for production by addition of gluten and starch were with (1) gluten meal, 229.7, and (2) starch meal, 250.6 grams.

The utilisation of the available energy of starch meal was on the whole higher than was the case with proteid.

N. H. J. M.

Experiments with Gluten, Starch Meal, and Oil. By OSCAR KELLNER, A. KÖHLER, W. ZIELSTORFF, FR. HERING, R. EWERT, and M. LEHMANN (*Landw. Versuchs-Stat.*, 1900, 53, 96—171).—During the first period of the experiments, the bullocks were fed with limited fattening food; in the second period, starch meal was given; in the third period, an amount of oil approximately isodynamic with the starch; and in the fourth period gluten meal.

The amount of carbon dioxide contained in the water consumed was determined.

The increase produced by 1 kilogram of the different foods was as follows: Starch meal, 215.8; earth-nut oil (reckoned as starch), 203.7; and gluten meal, 170.9 grams. As one part of oil is calculated to 2.27 parts of starch, the increase due to 1 kilogram of oil would be 462.4 grams.

N. H. J. M.

Experiments with Meadow Hay, Oat Straw, Starch Meal, and Molasses. By OSCAR KELLNER, A. KÖHLER, M. LEHMANN, FR. HERING, K. WEDEMAYER, and TH. METHNER (*Landw. Versuchs-Stat.*, 1900, 53, 172—277).—The results of experiments with two bullocks gave the following average amounts of increase for 1 kilogram of the food: Meadow hay, 149·7; oat straw, 148·7; starch meal, 255·8; earth-nut oil, 416·1; and molasses, 258·0 grams.

With exception of hay and oat straw, the numbers are not exact, and are, especially in the case of oil, too high.

Taking into account the alteration in live weight and surface, calculations are given of the percentage amounts of available energy in the increase. The results show that earth-nut oil takes the first place, (65·2—70·6 per cent.), then starch meal (65·2—66·0 per cent.) and molasses (60·3 per cent.). Meadow hay and oat straw gave much lower results (42·8—37·7 and 39·9—35·2 per cent.).

Hay, oat straw, and starch produced the greatest amounts of methane; oil, in some cases, diminished the amount of hydrocarbon produced from the other foods.

N. H. J. M.

Experiments with Meadow Hay, Wheat Straw, Starch Meal, Extracted Rye Straw, and Molasses. By OSCAR KELLNER, A. KÖHLER, M. LEHMANN, FR. HERING, K. WEDEMAYER, J. VOLHARD, H. PETERS, H. VON GILLERN, and O. ZAHN (*Landw. Versuchs-Stat.*, 1900, 53, 278—397).—The extracted rye straw was prepared by heating the straw (1 kilo.) under pressure with a solution (2070 c.c.) containing NaOH, 55; Na₂CO₃, 20; and Na₂S + Na₂S₂O₃, 22 grams per litre.

It was found that the cellulose of the extracted straw was of not less effect than starch, whilst the digestible matter of wheat straw, oat straw, and meadow hay produce much less increase. This difference is attributed to the presence, in the raw foods, of lignin-like substances. The raw foods require a greater expenditure of energy in chewing and digesting, and the passage of sparingly soluble matter into the lower intestines results in a loss of substance otherwise available for production of increase.

N. H. J. M.

Beet Molasses of Different Origin. By OSCAR KELLNER, H. PETERS, O. ZAHN, and A. STRIGEL (*Landw. Versuchs-Stat.*, 1900, 54, 113—123).—The molasses was in each case obtained from factories in which the diffusion process was employed. Molasses obtained directly from the juice contained more ash, nitrogen, and organic non-sugar than when the strontium process is used. The cane-sugar in the dry matter is about the same in both cases, but the dry matter of molasses from the strontium process contained 15·1 per cent. of raffinose.

The sp. gr. of the dry matter differed only slightly (1·679—1·709), and the results gave an average (1·692) almost identical with the number (1·69) obtained by Neubauer (*Landw. Versuchs-Stat.*, 1899, 51, 421).

N. H. J. M.

Milk and Artificial Foods for Fattening Calves. By D. DICKSON and L. MALPEAUX (*Ann. Agron.*, 1900, 26, 217—245).—Feeding with milk gives the best results both as regards amount and

quality. As regards substitutes for milk, starch and malt flour proved to be the best of the foods employed; but even with these it is an advantage to terminate the fattening with milk.

Decoction of linseed in conjunction with rice starch or flour gave good results as regards quality, whilst boiled malt flour mixed with skim milk also gives very good results. Margarine and sugar may be employed with milk from which the cream has been partially separated, and it is suggested that to separate the cream and replace it by margarine for calves is preferable to employing margarine for human consumption.

Many foods remain to be tried, and it is possible that some may furnish better results than those employed in the experiments described.
N. H. J. M.

Effect of Fatigue on the Quantity and Quality of Milk. By JOSEF L. HILLS (*12th Ann. Rep. Vermont Agr. Expt. Stat.*, 1898—1899, 309).—The cows had been driven about 10 miles, sent 70 miles by rail, the whole journey taking about 18 hours, during which time they were not milked. The amount (in lbs.) and percentage composition of the milk the day after arriving, and after 1 and 3 weeks, was as follows:

Amount (lbs.).			Total solids.			Fat.			Solids, not fat.		
1.	2.	3.	1.	2.	3.	1.	2.	3.	1.	2.	3.
122.5	122.3	131.4	15.19	13.73	14.10	5.94	4.43	4.32	9.25	9.80	9.28

The results show that milk should not be tested until the cows have recovered from the effects of fatigue.
N. H. J. M.

Effect of Food on the Hardness of Butter, and Composition of Butter Fat. By JAMES M. BARTLET (*14th Ann. Rept. Maine Agr. Expt. Stat.* for 1898, 97—113).—The object of the experiments was to ascertain the effect of different gluten meals on butter. Three kinds of meals were employed containing respectively about 15, 8, and less than 3 per cent. of fat. In one experiment with the meal containing the lowest percentage of oil, emulsified tallow was added to the food.

The results show that the hardness of butter can, to a great extent, be regulated by the food. Gluten products containing much oil produce soft butter; gluten meals with 3 per cent. of fat or less, and with high percentages of proteids, will make butter sufficiently hard when employed in conjunction with maize meal and bran. When freed from fat, the glutens will not, however, have the hardening effect of cotton seed meal.

The melting point of fat, as determined by the American official method, is not a true indication of the hardness; some fats of medium hard butters gave melting points practically the same as the softest butters. When, however, the melting point of the fat is low and the iodine number high, the butter is soft, and *vice versa*.

The production of soft butter cannot be attributed either to deficiency of nitrogenous food or to excess of fat; addition of 0.5 lb. of tallow to the ration caused the butter to become harder, and raised the melting point of the butter-fat. In some way, the properties of the food-fat are transmitted to the milk-fat.
N. H. J. M.

Effect of Feeding Fat on the Percentage of Fat in the Milk. By JAMES M. BARTLET (*14th Ann. Rep. Maine Agr. Expt. Stat.* for 1898, 114—117).—Albert and Maercker (*Landw. Jahrb.*, 1898, 27) found that rations rich in fat caused a decided increase in the fat of the milk; in another experiment it was found that in a longer period the yield of fat afterwards fell to about the same as it was previously with a ration poor in fat. The falling off was attributed to over-feeding with fat. Rhodin (*K. Landt. Akad. Handl.*, 1888, 37, 25), in experiments with emulsified oils also observed an increase of milk fat, followed by a fall to the normal amount.

The examination of the milk of cows fed with rations containing different amounts of fat (compare preceding abstract) showed a very decided increase in the percentage of fat in milk during the first two weeks of the period in which a ration rich in fat was fed; in the third week of the same period, the percentage of milk fat diminished. The following are the percentages of fat found each week. Period I (digestible fat, 0.36 lb. per day): (1) 5.34, (2) 5.21, (3) 5.66, (4) 5.94. Period II (0.86 lb. fat): (5) 6.39, (6) 6.43, (7) 6.05, (8) 6.15. Period III (0.55 lb. fat): (9) 5.64, (10) 5.78, (11) 5.96, and (12) 5.74. The decrease of milk-fat in the third period is attributed to the gradual return of the cows to their normal capacity.

N. H. J. M.

Effect of Emulsified or Non-emulsified Fat on [Milk] Production. By JOSEF L. HILLS (*12th Ann. Rep. Vermont Agr. Expt. Stat.* for 1898—1899, 269—275).—From the results of two years' experiments the following conclusions are drawn. Addition of cotton seed, maize, or linseed oils tends to increase the yield of milk per unit of dry matter consumed. With cotton seed oil there seems to be a fairly permanent increase of 0.2—0.3 per cent., in the fat of the milk, but maize and linseed oils, when fed as a regular diet, seem to lower the percentage of fat, although, when first given, all the oils produced marked gains in milk fat. The improvement in the quality of the milk under the influence of cotton seed oil took place both with emulsified oil and oil which had not been emulsified.

By feeding with oil, the butter is injured to an extent which far outweighs any possible benefit from increased yield and quality (compare following abstract).

N. H. J. M.

Effect of Food on the Quality of Butter. By JOSEF L. HILLS (*12th Ann. Rep. Vermont Agr. Expt. Stat.*, 1898—1899, 296—298. Compare this vol., ii, 236).—The rations contained hay and usually silage besides cotton seed, linseed and maize meals, and bran, in two different combinations; maize meal and bran; maize meal, bran, and buckwheat middlings; Buffalo gluten feed; Tucker oat feed. At times emulsified cotton seed, maize, and linseed oils were added to the maize and bran ration. The following average results were obtained with the butter:

Without oil.			Maize oil.			Cotton seed oil.			Linseed oil.		
Vola- tile	Iodine num-		Vola- tile	Iodine num-		Vola- tile	Iodine num-		Vola- tile	Iodine num-	
acids.	ber.	M. p.	acids.	ber.	M. p.	acids.	ber.	M. p.	acids.	ber.	M. p.
29.3	28.0	33.8°	17.8	44.7	34.3°	23.2	39.8	36.4°	20.2	47.8	34.1°

The effects of the oil, especially maize and linseed oil, were maintained for some time after the oil was discontinued. The cotton seed butter was hard and of good quality, the linseed butter very soft and sticky, whilst the maize oil butter was rather soft and oily, but of fair quality.

It is hardly safe to conclude that the oils actually migrate to the milk, but the results lend support to this view. N. H. J. M.

Composition and Food-value of the Salt Bushes. By MEJER E. JAFFA (*Univ. California Agr. Expt. Stat. Bul.*, 125, 1899, 24—30).—The percentage composition of two samples of *Atriplex semibaccata* grown at Tulare and Paso Robles was found to be as follows:

	Water.	Crude proteid.	N-free extract.	Crude fat.	Crude fibre.	Pure ash.
1.	78.03	2.75	10.41	0.48	3.75	4.58
2.	75.00	3.93	10.15	0.41	5.58	4.93

As regards digestibility, feeding experiments are required. In the meantime, the author would assign to the hay about the same digestive coefficients as for oat hay. Salt bushes should not be fed alone, owing to the high percentage of saline ingredients, and should be given in gradually increasing amounts. Sheep and cattle have, however, been fed exclusively with the material throughout an entire season.

The composition of the ash (of 1) is as follows:

Na_2O .	K_2O .	CaO .	MgO .	Fe_2O_3 .	Al_2O_3 .	Mn_2O_4 .	P_2O_5 .	SO_3 .	SiO_2 .	Cl.
85.39	11.42	5.79	3.23	1.38	1.95	0.22	2.30	2.64	16.24	24.33

Although the percentages of potash and phosphoric acid are low, the actual amounts are much greater than those yielded by an ordinary crop of hay. N. H. J. M.

Edible Earth from Fiji. By B. G. CORNEY, DAVID, and FREDERICK B. GUTHRIE (*Journ. and Proc. Roy. Soc. N.S. Wales*, 1900, 33, 224—227).—The sample of soil was obtained from the Island Vanua Levu, and consists of a very soft, pale pink, clayey material with small, white patches, and lumps of grey to reddish chalcedony. It contained a good many quartz crystals and numerous small, octahedral crystals of magnetite. It therefore seems likely that the rock was originally a quartz andesite (dacite), probably of tuffaceous origin. The following analytical results are given:

Loss at 120°.	Combined water.	Al_2O_3 .	Fe_2O_3 .	SiO_2 .
2.45	12.78	41.53	7.66	35.09

The substance contains no lime or magnesia, and would seem to be a silicate of the formula $\text{Al}_2\text{O}_3(\text{SiO}_2)_2(\text{H}_2\text{O})_2$, with ferric oxide as impurity. N. H. J. M.

Basic Constituents of Crops. By ROBERT WARINGTON (*Agr. Students' Gaz.*, 1899, [ii], 9, 133—138).—The author remarks that he had previously pointed out that the carbonates found in plant ashes must be in part a residue of nitrates. The bases of the nitrates remain, after the nitric nitrogen has been utilised by the plant, and probably become united with organic acids.* The results of calculations of the lime corre-

* Compare Lawes and Gilbert (*Journ. Roy. Agric. Soc. Eng.*, 1894, [iii], 5, 636—641; *Proc. Roy. Soc.*, 1899, 65, 329—332; and *Phil. Trans.*, 1900, 192, B., 150—174).

sponding with the whole of the nitrogen of various crops, and of the amounts of lime equivalent to the bases of the ash, after satisfying the phosphoric (assumed to be dibasic) and hydrochloric acids present, showed, in every case, with the exception of mangels, a great deficiency of bases on the assumption that most of the nitrogen enters into the plant in the form of nitrate. The results of Arendt's experiments with oat-plants which were analysed at different dates, from June 10 to July 31, showed a falling off in the salifiable base as percentage of nitrate base from 41—44 to 27.

Unless, therefore, cereals take up only about a quarter of their total nitrogen in the form of nitrates, it must be assumed, as is probably the case, that a loss of bases occurs. The differences in the amount and composition of barley straw harvested at Rothamsted in wet and dry seasons, indicated that losses occur owing to the washing out of withered stems and leaves in wet weather. There is probably also a loss of ash-constituents by diffusion into the soil, especially when the crop ripens and the sap becomes more and more concentrated. The diffusion into the soil would occur chiefly during the night.

N. H. J. M.

[Basic Constituents of Crops.] By EM. DEMOUSSY (*Ann. Agron.*, 1900, 26, 251—257).—With reference to the preceding paper, it is pointed out that, although plants do not take up much nitrogen in the form of ammonia, since the soil generally contains very little, any ammoniacal nitrogen taken up would further increase the deficiency of base by leaving the acid of the ammonium salt in the plant.

The deficiency of bases in plant ashes is attributed partly to a certain amount of nitrogen being taken up in other forms than nitrate, especially as organic compounds, and partly to losses in dead leaves both attached and fallen. The results of experiments with wheat showed that losses of dry matter, greater losses of total ash, and still greater losses of potash took place in July (compare Dehérain and Bréal, *Abstr.*, 1882, 419; Rouf, "Étude anal. sur la canne à sucre," *La Martinique*, 1879, and Dehérain, *Ann. Agron.*, 1879, 5, 271).

The possibility of losses of ash constituents by diffusion into the soil when the concentration of the sap increases was suggested by Marie-Davy and Albert Lévy (*Ann. Montsouris*, 1873 and 1876), but the results of experiments by the author and others indicate that living portions of plants retain with great vigour all the mineral matter absorbed. Knop's results were probably due to mutilated plants having been employed (compare *Abstr.*, 1894, ii, 153).

N. H. J. M.

Manurial Experiments with Fruit Trees. By STROBLICH (*Bied. Centr.*, 1900, 29, 292—296; from *Mitt. Deut. Landw. Ges.*, 1897, No. 4, 39).—The percentage amounts of food constituents in fruit trees increase from the root-wood to the fruit-wood, and are still greater in the leaves. The amount of nitrogen in the vegetative organs is always greater than that of the potash.

The yearly amounts of nitrogen, potash, lime and phosphoric acid required by fruit trees with stems 25 cm. in circumference have been estimated. The following results are given (in grams) for apple, pear,

cherry, and plum trees : N, 59, 37, (76) and (34) ; K_2O , 51, 40, 95, and 74 ; CaO , 109, 69, 209, and 75 ; P_2O_5 , 11, 7, 30, and 11. Provisional estimates were made of the manurial requirements of fruit trees for each cm. of circumference.

A large number of measurements and weighings have been made, the results of which show the relations of the amounts of total wood to the amount of stem wood, the average increase in circumference per annum, and the relation of the amount of foliage to the circumference of the trees, &c.

N. H. J. M.

Storage of Stable Manure. By FRIEDRICH HOLDEFLEISS (*Mitteil. Landw. Inst. kgl. Univ. Breslau*, 1900, Heft. 3, 49—55).—Three samples of manure from previous experiments (*ibid.*, Heft. 2) were employed. They contained 6415, 5532, and 5480 grams of total nitrogen respectively ; 7.35, 3.61, and 2.05 per cent. of the nitrogen were in the form of ammonia, and 88.2, 88.3, and 92.3 per cent. were in the form of proteids. The three lots were kept (1) without preservative, (2) with potassium salt, and (3) with superphosphate.

The percentage losses or gains of the different constituents were as follows :

	N.	N as NH_3 .	Proteid N.	Non-proteid organ. N.	Non-nitrog. extract.	Crude fibre.	Pentosans.
1.	-18	-64	-20.3	+105	-8.7	-27.5	-35.1
2.	-6.3	+48	-11.3	+32	-27.5	-6.9	-16.7
3.	-6.75	+306	-14.1	no change	-27.5	-9.4	-22.5

As regards nitrogenous constituents, the effect of preservatives was not only to diminish the loss of proteid nitrogen, but to increase considerably the amount of nitrogen in the form of ammonia.

Of the non-nitrogenous constituents, the pentosans and non-nitrogenous extract are the substances which decomposed most readily. In crude fibre *minus* pentosans there was only a loss in (1) amounting to 17.5 per cent. ; in (2) and (3) there were gains of 7.6 and 7.9 per cent.

N. H. J. M.

Analytical Chemistry.

Burette for Accurate Gas Analysis. By ALFRED H. WHITE (*J. Amer. Chem. Soc.*, 1900, 22, 343—349).—This is an improvement on the Hempel-Petterson apparatus. For working particulars, reference must be made to the original with its five illustrations.

The main body of the burette consists of 12 bulbs, each with a capacity of about 12 c.c. A line is etched on each constriction and the capacity of the bulb between these marks is determined ; no reading telescope is required, yet the volume of the gas may be read off within 0.02 c.c.

The other parts of the apparatus, which is enclosed in a water-jacket, consist of a side burette and of a manometer placed below

a specially constructed stopcock which prevents the escape of gas or entrance of outer air when connection is made with the absorption pipettes.

The burette in which mercury is employed compensates automatically for all changes of temperatures and pressure.

L. DE K.

Alkalimetry and Acidimetry in Volumetric Analysis. By A. ASTREUC (*Compt. rend.*, 1900, 130, 1636—1639).—The author summarises and discusses the various observations which have been made on the behaviour of phenols, amines, organic acids, and other carbon compounds with various indicators.

C. H. B.

New Methods of Mineral Analysis. By ADOLPHE CARNOT (*Ann. des Mines*, 1898, [ix], 14, 113—209).—A collection is given of 21 methods which have previously been published separately (*Abstr.*, 1898, ii, 349, &c.).

L. J. S.

Iodometric Estimation of Hydrogen Peroxide, Alkali Percarbonates and Persulphates. By ERWIN RUPF (*Arch. Pharm.*, 1900, 238, 156—158).—Hydrogen peroxide may be estimated with great accuracy by adding 1 c.c. of the sample to 20 c.c. of water mixed with 5 c.c. of dilute sulphuric acid and 1 gram of potassium iodide. After being kept for half an hour in a closed flask, the liberated iodine is titrated, as usual, with *N*/10 sodium thiosulphate. Percarbonates may be estimated in a similar manner. The process is also applicable to persulphates, but the time of reaction should be extended to 2 hours.

L. DE K.

Detection of Fluorine in Wine. By GIULIO PARIS (*L'Orosi*, 1900, 23, 1—3).—The ignited ash from 50 c.c. of the wine is mixed in a platinum crucible with one-third of its weight of precipitated silica and about 0.5 c.c. of concentrated sulphuric acid. The lid of the crucible, on the bottom of which is suspended a drop of distilled water, is then put on and a little ice placed on the upper surface. After heating the crucible with a very small flame for about 5 minutes, it is allowed to cool and the drop of water hanging from the lid is removed to a microscope slide, a small portion of which is covered with a thin uniform coating of Canada balsam. A few small crystals of sodium chloride are then added and after a lapse of half an hour to an hour the slide is examined under the microscope; if the wine contains fluorine, hexagonal crystals of sodium silico-fluoride are observable.

T. H. P.

Estimation of Ozone. By OTTO BRUNCK (*Ber.* 1900, 33, 1832—1842. Compare Ackermann, *Chem. Zeit.*, 1900, 24, 235).—In the estimation of ozone by the liberation of iodine from potassium iodide solution, trustworthy results can only be obtained when the solution is treated with the theoretical amount of sulphuric or acetic acid necessary to liberate hydrogen iodide. When a neutral solution of potassium iodide is employed, the amount of ozone always comes too low, probably owing to the formation of potassium peroxide which destroys part of the iodine and also to the interaction of ozone and hydrogen peroxide. In acid solutions, a slight error occurs when very

concentrated solutions are employed, owing to decomposition of the hydriodic acid, but this may be eliminated by making a blank determination. J. J. S.

Selenium and Tellurium. By EDWARD KELLER (*J. Amer. Chem. Soc.*, 1900, 22, 241—245. Compare Abstr., 1898, ii, 638).—*Quantitative Separation of Selenium and Tellurium.* The method is based on the fact that selenious acid dissolved in strong hydrochloric acid is reduced by sulphur dioxide; any tellurous acid may then be reduced by adding water and boiling. The process has been derived more particularly for the analysis of crude copper.

One hundred grams of copper with 2—4 grams of ferrous sulphate are dissolved in 400 c.c. of nitric acid (sp. gr. 1.42), the nitrous fumes expelled, and the solution diluted, cooled, and mixed with sufficient ammonia to redissolve the copper precipitate. After boiling and settling, the ferric hydroxide containing the selenium and tellurium is collected on a filter; as it always retains copper, it must be repeatedly redissolved in acid and reprecipitated with ammonia. The precipitate is then dissolved in just sufficient hydrochloric acid, saturated with hydrogen sulphide, and the precipitated sulphide after being well washed is digested with sodium sulphide, which dissolves the sulphides of selenium and tellurium. The filtrate is carefully acidified with nitric acid and evaporated to dryness; the residue now contains the dioxides of selenium and tellurium, besides sodium nitrate and some sulphur. Two hundred c.c. of strong hydrochloric acid are added and the whole is boiled until all nitro-hydrochloric acid is expelled and the two elements have been reduced to the lower state of oxidation. When cold, the liquid is passed through a Gooch filter and the residue washed with strong hydrochloric acid. A current of sulphur dioxide is now passed through the solution to precipitate the selenium which is washed first with dilute hydrochloric acid, then with water, and finally with alcohol, and is then dried and weighed. The filtrate containing the tellurium is diluted with an equal bulk of water and boiled to precipitate the tellurium, more sulphur dioxide being passed if necessary. It is then collected and treated in the same manner as the selenium. The results are quite satisfactory, notwithstanding Lenher's assertions that small quantities of selenium cannot be accurately estimated in the presence of much tellurium; the amount of hydrochloric acid should, however, be about 100 times that of the tellurium. L. DE K.

Distillation of Ammonia in the Estimation of Nitrogen. By FRANCIS GANO BENEDICT (*J. Amer. Chem. Soc.*, 1900, 22, 259—263).—When distilling dilute solutions of ammonia, this is generally expelled in a very short time, but still it is necessary to keep on distilling a considerable volume in order to wash out the ammonia adhering to the condensing tube. If the latter is not cooled, the ammonia is very soon expelled, but this causes other inconveniences, such as the possible overheating of the standard acid into which the ammonia is received.

The author now combines the two methods. The vapour passes through a vertical tin condensing-tube fixed into a galvanised iron tank filled with water, which may be drawn off by means of a tap. When the bulk

of the ammonia is supposed to have passed over, the refrigerating water is slowly withdrawn, thus allowing the tube to get hot.

L. DE K.

Rapid Method for the Estimation of Carbon in Iron or Steel by Combustion. By GEORGE W. SARGENT (*J. Amer. Chem. Soc.*, 1900, 22, 277—285).—This is a modification of the ordinary process of burning the carbonaceous residue of iron or steel in a current of air or oxygen. The air or oxygen employed is first passed over a red-hot spiral made from a platinum tube 17 inches long and $\frac{5}{8}$ inch in diameter; this gives four close coils $\frac{3}{4}$ inch in diameter, and leaves 4 inches extended on either side. The object is to fully oxidise any hydrocarbons which may be present in the air, and the carbon dioxide formed is then absorbed in a Geissler bulb apparatus. The carbon is placed in a porcelain boat heated inside a porcelain combustion tube, and the resulting gases are passed through a tube containing red-hot copper oxide to insure complete oxidation. It has been found that the same object is attained by passing the gases through a small glass tube in which two platinum wires were fused, so that a spark would be produced between the points, when a current from a Rhumkorff coil passed through the wires. As there is, however, always a danger of stoppage, the use of copper oxide is the safest. To retain traces of hydrochloric acid or chlorine, the gases are afterwards passed through a $\frac{1}{4}$ -inch glass tube 6 inches long, containing loosely-packed coarse wet sand held in place by two small discs of copper gauze placed at either end.

Precautions are taken to prevent overheating of the corks. The dried gases are then finely absorbed in a weighed Geissler apparatus of somewhat larger size than usual, and containing 30 c.c. of aqueous caustic potash of sp. gr. 1.27.

L. DE K.

Estimation of Carbon in Steel. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1900, 22, 334—343).—The method of estimating the carbon by igniting the carbon sponge, and attributing 70 per cent. of the loss in weight to the presence of carbon, is said to be untrustworthy. No better results are obtained by treating the carbon sponge with nitric acid.

The colour tests are also untrustworthy, the same sample giving sometimes a difference of 0.1 per cent. of carbon.

Sources of error are pointed out in the moist and dry combustion process; as regards the latter, Shimer's apparatus will, in the author's opinion, eventually displace the old arrangement.

L. DE K.

Estimation of Carbon and Sulphur in Steel. By BEETRAM BLOUNT (*Analyst*, 1900, 25, 141—144).—The author has attempted to estimate carbon and sulphur in iron by direct combustion in pure oxygen. The sample is heated at about 1200° in a porcelain boat contained in a porcelain tube, and the products of combustion are passed into suitable absorbents. The process does not answer well for sulphur, and even for carbon it is not as yet preferable to the existing methods. It might be made more generally applicable if

means were found to completely oxidise the iron at a temperature not exceeding 800°.

L. DE K.

Estimation of Alkali Carbonates in Presence of Alkali Hydrogen Carbonates. By FRANK K. CAMERON (*Amer. Chem. J.*, 1900, 23, 471—486).—Alkali carbonates interact with potassium hydrogen sulphate to give sodium hydrogen carbonate and sodium potassium sulphate; since both the latter are neutral to indicators, the carbonates can be separately estimated by adding a standard solution of the acid sulphate until the pink coloration of the phenolphthalein disappears; the hydrogen carbonates are, however, unstable, and gradually decompose into carbonates and carbon dioxide. Salts of other weak acids, such as the borates, silicates, and phosphates, can be similarly estimated.

The hydrogen carbonates do not yield a CO_3 ion, except by decomposition into carbonates, and do not themselves precipitate silver salts; chlorides can therefore be titrated directly against silver nitrate in presence of hydrogen carbonates, if the decomposition of the latter is prevented by a very slight excess of acid sulphate.

T. M. L.

Estimation of Calcium and Sulphuric Acid by the Photometric Method. By J. I. D. HINDS (*J. Amer. Chem. Soc.*, 1900, 22, 269—274).—The author has extended his process (*Abstr.*, 1896, ii, 574) to the estimation of calcium in limestone. About 0.10 of the sample is dissolved in hydrochloric acid and a few drops of nitric acid, and evaporated to dryness over a free flame. The residue is dissolved in water with a little hydrochloric acid, neutralised with ammonia diluted to 150 c.c., and mixed with a little solid ammonium oxalate. The turbid liquid is then poured into the apparatus previously described until the image of the candle flame just disappears. The depth is read and the percentage of calcium in the liquid is calculated from the equations:

For calcium carbonate, $y = 0.0642/x - 0.3$; for calcium oxide, $y = 0.0360/x - 0.3$, in which x is the reading of the cylinder in cm. and y the percentage sought.

The percentage of calcium in the sample is then found by an easy calculation.

Small quantities of sulphuric acid in liquids may be similarly estimated by adding solid barium chloride and using the equations:

For H_2SO_4 , $y = 0.0590/x$; for SO_3 , $y = 0.0482/x$.

Tables are given to save the trouble of calculating.

L. DE K.

Estimation of Zinc by the Use of Standard Thiosulphate Solution. By RICHARD K. MEADE (*J. Amer. Chem. Soc.*, 1900, 22, 353—356).—The author recently proposed a new volumetric process for the estimation of magnesium (this vol., ii, 48), and has applied the same principle to the estimation of zinc. The strongly ammoniacal solution is mixed with sodium arsenate, and any precipitate due to calcium, magnesium, &c., is filtered off. The filtrate is nearly neutralised with nitric acid and then faintly acidified with acetic acid. After being washed, the precipitated zinc arsenate is dissolved in

dilute hydrochloric acid, potassium iodide added, and the liberated iodine titrated with standard sodium thiosulphate, addition of starch being superfluous.

Manganese, which is frequently present in zinc ores, must be first removed by treating the sample with nitric acid and potassium chlorate.

L. DE K.

Quick and Exact Test for Mercury in Urine. By ADOLF JOLLES (*Monatsh.*, 1900, 21, 352—360; *Zeit. anal. Chem.*, 1900, 39, 230—237).—The urine (100—150 c.c.) acidified with concentrated hydrochloric acid (5—10 c.c.) is heated with potassium chlorate (1.5—2 grams) until it no longer smells of chlorine, and then mixed with a dilute solution of stannous chloride; in this mixture, a gilt platinum foil is placed for 15 minutes; the foil is then treated with nitric acid and the solution evaporated to a small bulk and tested with stannous chloride or hydrogen sulphide. It is thus possible to detect 0.000066 gram of mercury in 100 c.c. of urine. A quantitative method is based on the same test, the yellow coloration produced by hydrogen sulphide in the dilute mercury solution being compared with that of solutions of known strength.

R. H. P.

Separation and Estimation of Mercury as Mercurous Oxalate. By C. A. PETERS (*Amer. J. Sci.*, 1900, [iv], 9, 401—406).—Mercury in solution as mercurous nitrate may be estimated volumetrically by adding a known weight of ammonium oxalate and titrating the excess of oxalic acid in the filtrate with standard solution of potassium permanganate. An attempt to estimate the oxalic acid in the precipitate proved unsuccessful.

In solutions containing from 2—5 per cent. of excess of nitric acid (sp. gr. 1.15), mercurous salts may be quantitatively separated from mercuric salts if the latter do not exceed 20 per cent. of the total mercury.

Instead of estimating the mercurous compound volumetrically, the precipitated mercurous oxalate may be weighed as such. As it is not stable at 100°, however, it should be collected on a weighed asbestos filter and dried over sulphuric acid to constant weight, which is generally accomplished in about 15 hours if the weight does not exceed a few decigrams.

L. DE K.

Estimation of Cerium. By GEORG VON KNORRE (*Ber.*, 1900, 33, 1924—1929. Compare Abstr., 1898, ii, 311; Job, Abstr., 1899, ii, 334).—Cerium in ceric salts may be readily estimated by reduction with excess of hydrogen peroxide and subsequent estimation of the excess of peroxide by standard permanganate. Hitherto, no good method has been described for the oxidation of cerous to ceric salts; the author finds, however, that extremely dilute solutions of cerous compounds which have been acidified with the smallest possible amount of sulphuric acid are readily oxidised by boiling for a few minutes with ammonium persulphate; the change in colour, from colourless to yellow, is very characteristic, and may possibly be the most delicate test for cerium. The subsequent estimation of the ceric compound is carried out as just described.

J. J. S.

Estimation of Alumina and Ferric Oxide in Natural Phosphates. By F. P. VEITCH (*J. Amer. Chem. Soc.*, 1900, 22, 246—258).—*Estimation of Alumina.*—One gram of the substance is treated in a platinum dish with 5—10 c.c. of hydrofluoric acid and after 2 or 3 hours the solution is evaporated to dryness on the water-bath; 2 c.c. of sulphuric acid are added, and the whole gently heated until the substance no longer flows in the dish. When cold, 10—20 c.c. of hydrochloric acid are added, and after warming a few minutes to soften the mass this is transferred to a small beaker and boiled for 15—30 minutes to dissolve all aluminium compounds. The liquid is then diluted and passed through a filter and the undissolved matter is well washed. To the filtrate are added 50 c.c. of a 25 per cent. solution of ammonium chloride, then ammonia until alkaline, and then enough hydrochloric acid to just redissolve the precipitate. When cold, the mixture is diluted to about 250 c.c., and a 50 per cent. solution of ammonium thio-sulphate is added drop by drop until the solution is colourless, adding in all 20 c.c.; the beaker is covered with a watch glass and the mixture is boiled for half an hour. The precipitate, after being drained, is washed back into the same beaker, redissolved in hydrochloric acid, mixed with 2 c.c. of a 10 per cent. solution of ammonium phosphate, and reprecipitated in the way described. The aluminium phosphate is washed 20 times with a 5 per cent. solution of ammonium nitrate and ignited over the blowpipe to constant weight.

Estimation of Ferric Oxide.—One gram of the substance is heated with 20 c.c. of sulphuric acid. The mixture is diluted with water and filtered; should organic matter be suspected, the solution is boiled for some time with addition of a little potassium chlorate. The mixture is then reduced with zinc in the ordinary way, and titrated with a standardised solution of potassium permanganate.

Part of the paper is devoted to a criticism of existing methods.

L. DE K.

Preparation of Potassium Xanthate for Nickel Estimations. By EDWARD D. CAMPBELL (*J. Amer. Chem. Soc.*, 1900, 22, 307—308. Compare Abstr., 1895, ii, 421).—As commercial potassium xanthate is often not sufficiently pure, it is advisable to prepare the salt specially. Fused potassium hydroxide is placed in a tightly stoppered flask and covered with absolute alcohol, of which 2.5 c.c. should be used for each gram of the hydroxide. When dissolved, the liquid is poured off from any undissolved carbonate into a beaker which is placed in ice-water until the temperature is reduced to 10° or less, and carbon disulphide is gradually added with constant stirring, using 1 c.c. for each gram of potassium hydroxide. The crystalline mass is collected on a Buchner funnel, using the suction-pump, washed once with a very little absolute alcohol, and then twice with a little ether. When properly dried at about 100°, the compound will keep for years.

L. DE K.

Colorimetric Estimation of Vanadium. By LOUIS MAILLARD (*Bull. Soc. Chim.*, 1900, [iii], 23, 559—563).—The method described is adapted for the estimation of small quantities of vanadium, and is

based on the red coloration, probably due to the formation of a per-vanadic acid, produced by the action of hydrogen peroxide on vanadic acid. 10 c.c. of the liquid under examination are placed in a graduated cylinder, 1—5 c.c. of hydrochloric acid and 3—10 c.c. of an ethereal solution of hydrogen peroxide added, the mixture well agitated, and water added until the aqueous layer measures 15 c.c. The operation is repeated with 10 c.c. of a 0.1 per cent. solution of sodium vanadate, and the two liquids examined and compared in a colorimeter. Experiments are cited to prove that the intensity of the coloration is strictly proportional to the amount of vanadic acid present, and is not affected by excess of acid and hydrogen peroxide, or by the presence of various salts. N. L.

Electrolytic Estimation of Bismuth. By DMITRY BALACHOWSKY (*Compt. rend.*, 1900, 131, 179—182).—An adherent deposit of bismuth, suitable for quantitative estimations, may be obtained by working with feeble currents (maximum current density $ND_{100} = 0.06$ ampere), roughened electrodes, and slightly acidic solutions, free from large quantities of haloid salts.

About 0.6 gram of the sulphate or nitrate, mixed with 3—4 grams of carbamide, and dissolved in 5—6 c.c. nitric acid, diluted with 150 c.c. of water, are electrolysed in a roughened Classen capsule for 6—8 hours at 60°, with a current density of 0.03—0.04 ampere, and a difference of potential 1.5—1.9 volts; towards the close of the electrolysis, the current density is increased to 0.08 ampere, and the E.M.F. to 2 volts.

Formaldehyde or acetaldehyde may be added instead of carbamide, and in this case the operation is finished by warming to 80—90°, and slightly decreasing the voltage and current density.

The precipitated metal is washed without stopping the current, and dried at 100°; the deposit is readily removed from the capsule by the action of nitric acid. The analytical results are exhibited in tabular form. G. T. M.

Bismuth Cobalticyanide. By JOHN A. MATHEWS (*J. Amer. Chem. Soc.*, 1900, 22, 274—277).—Further particulars are given about the constitution and properties of bismuth cobalticyanide (this vol., ii, 318). The results have not been favourable to the proposed use of potassium cobalticyanide in the analysis of pig-leads, but the salt may be used in the analysis of regular lead-bismuth alloys. It has been found that unless 1 c.c. of the liquid contains at least 0.0079 gram of bismuth, the precipitation is not complete in any circumstances. As a rule, the precipitation is favoured by operating at the boiling heat; once a precipitate is formed, it does not redissolve even in a quantity of water, which would have prevented its formation at the beginning. A large excess of the reagent also increases its insolubility, also the presence of free acetic acid. Bismuth cobalticyanide is crystalline, settles and filters well, and does not completely give up its water below 165°. The formula of the dry compound is $\text{BiCo}(\text{CN})_6$. When freshly thrown down, the precipitate looks white, but on the filter it acquires a greenish tint, which, on drying, changes

to blue; on exposure to the air, it reabsorbs water and assumes a pink colour.

L. DE K.

Determination of the Hardness of Water. By GIUSEPPE VENTUROLI (*L'Orosi*, 1900, 23, 39—43).—To obviate the inconveniences of the Clark method and its modifications for determining the hardness of water, the following process is recommended. 40 c.c. of the water are acidified with hydrochloric acid and evaporated to dryness, the residue being dissolved in distilled water, and the solution mixed with a measured volume (50 to 60 c.c.) in excess of standard sodium carbonate solution (0.429 gram of Na_2CO_3 per litre). After heating to boiling and adding methyl-orange (or another indicator), the excess of sodium carbonate present is determined by titration with an acid solution of strength equivalent to that of the sodium carbonate solution. This gives the total hardness, each c.c. of the sodium carbonate solution corresponding with 1 part of calcium carbonate per 100,000 parts of water. To obtain the separate proportions of lime and magnesia in the water, it is necessary to determine, besides the total hardness, (1) the hardness after the calcium salts have been precipitated with ammonium oxalate solution, this giving the total amount of magnesia; (2) the hardness after the water has been boiled, representing the lime and magnesia not combined with carbonic acid; (3) the hardness after the removal of the calcium salts from the boiled water by means of ammonium oxalate, this giving the amount of magnesia not in combination with carbonic acid.

T. H. P.

West Indian Sandalwood Oil. By ERNST DEUSSEN (*Arch. Pharm.*, 238, 149—156. Compare *Abstr.*, 1899, i, 924; this vol., i, 242, 401).—This oil may be identified by the large amount of santalol it contains. The percentage of this alcohol in sandalwood oil may be calculated from the equation $P = a \times 22.2/s - (a - 0.42)$, in which a represents the number of c.c. of normal alkali consumed, and s the number of grams of the acetylated oil used in the experiment. As the constitution of this oil is but little known, the author has subjected a genuine sample to fractional distillation, analysis and further research.

The oil boils at 265° under atmospheric pressure, undergoing slight decomposition, but on distilling under 23 mm. pressure 6 fractions were obtained, boiling respectively at 139 — 147° , 147 — 155° , 155 — 160° , 160 — 168° , 168 — 171° , and 171 — 174° , a small quantity of resinous matter remaining in the flask. Most of the oil was contained in fractions 2, 4, and 6. Of these, 2 and 4 were subjected to ultimate analysis, and their molecular weight was determined by the freezing point method; the results obtained showed that these fractions probably contain a mixture of a sesquiterpene alcohol and a sesquiterpene.

By treating a solution of the oil in twice its volume of dry ether with hydrogen chloride, bromide, or iodide, crystalline compounds were obtained which chemically and physically corresponded with those of cadinene. There is, therefore, little doubt that sandalwood oil contains cadinene, the amount being about 16 per cent.

L. DE K.

Valuation of Spirit of Camphor. By ALFRED PARTHEIL and A. VAN HAAREN (*Arch. Pharm.*, 1900, 238, 164—166).—See this vol., i, 507.

Assay of Creosote. By A. D. HALL (*Analyst*, 1900, 25, 148—151).—One hundred c.c. of the sample are put into a distilling flask and the measuring flask is rinsed with 5 c.c. of benzene which are afterwards deducted from the volume of the distillate. After distilling until nothing more comes over at 325° , the volume of the distillate is read off. This is then shaken with 100 c.c. of sodium hydroxide solution of sp. gr. 1.2 or 1.3, and the mixture put in a water-oven for at least 1 hour, being shaken from time to time; when cold, the volume of the alkaline solution is read off and the greater part is withdrawn by means of the tap attached to the graduated cylindrical receiver.

The soda solution is boiled for a few minutes to expel hydrocarbons. When cold, 10 c.c. are withdrawn by a pipette and introduced into a Leffmann-Beam milk bottle (specially calibrated for the purpose); dilute sulphuric acid is added to neutralise the alkali, and the bottle whirled in the machine for a few minutes. When cold, the volume of the tar acids is read off.

To the contents of the receiver 100 c.c. of dilute sulphuric acid (1:5) are now added, and the whole is heated and shaken as before. The volume of the acid is then read off and 10 c.c. are mixed with excess of alkali in a milk bottle, which on being whirled causes the liberated tar bases to collect in the neck, when their volume may be read off.

Technical experiments not yet concluded seem to point to the fact that the pyridine tar bases are quite as valuable for preservative purposes as the tar acids.
L. DE K.

Volumetric Valuation of Syrup of Ferrous Iodide. By ERWIN RUFF (*Arch. Pharm.*, 1900, 238, 159—160).—The process is based on the fact that on adding potassium permanganate to an acid solution of ferrous iodide the iodine is liberated. On adding potassium iodide, this dissolves and at the same time a further amount of iodine is liberated by the action of the ferric salt on the potassium iodide; the iodine may then be titrated with sodium thiosulphate. When dealing with syrup of ferrous iodide, the unavoidable excess of permanganate is rapidly decomposed by the sugar.

Five grams of the syrup, 5—10 c.c. of water, and 10 c.c. of dilute sulphuric acid are introduced into a 100 c.c. stoppered bottle and a 1 per cent. solution of potassium permanganate is slowly added until the liquid remains pink for a few seconds. After 3 hours, one or two grams of potassium iodide are added, and after remaining in the dark for another hour, the liberated iodine is titrated with *N*/10 sodium thiosulphate, using starch as indicator. A 5 per cent. solution of ferrous iodide consumes 24.2 c.c. of *N*/10 sodium thiosulphate.

L. DE K.

Relation of the Reducing Power of Normal Urine to the Amount of Certain Nitrogen Compounds Present. By JOHN H. LONG (*J. Amer. Chem. Soc.*, 1900, 22, 309—327).—The copper solution used

in the experiments was prepared by dissolving in water 8.166 grams of crystallised copper sulphate, 15 grams of 100 per cent. sodium hydroxide, 25 c.c. of glycerol, 350 c.c. of ammonia of sp. gr. 0.9 and diluting to 1 litre. Fifty c.c. are diluted with 50 c.c. of water and boiled in the well-known Pavy apparatus; to prevent too rapid an escape of ammonia, some paraffin wax is added, also a few fragments of pumice-stone, and the burette tip for discharging the sugar solution or the urine is made long enough to pass down the neck of the flask and below this paraffin. If the saccharine solution contains 0.2 per cent. of dextrose, then 1 mol. of this will reduce exactly 5.88 mols. of copper oxide. Using this solution with uric acid and creatinine, it was found that 1 mol. of the former reduces 2.98 and 1 mol. of the latter 1.998 mols. of copper oxide. Processes are given for the estimation of these substances in urine so as to be able to allow for their reducing power when estimating the reducing power of a sample of urine. This reducing power is larger than that caused by uric acid and creatinine, proving the presence of normally existing sugar and, possibly, other reducing substances.

Estimations of urea by the mercury and hypobromite methods and its relation to the uric acid are also given. L. DE K.

Estimation of Glycogen. By EDUARD PFLÜGER (*Pflüger's Archiv*, 1900, 80, 351—369, 527—532; 81, 1—7. Compare Abstr., 1899, ii, 529, 819).—Largely polemical. Austen's method of estimating glycogen consists in a preliminary digestion of the substance with Finkelberg's pepsin, and subsequent treatment according to Külz's method. The pepsin used, however, contains a variable amount of glycogen or a similar polysaccharide; the glycogen obtained contains nitrogen, and a loss of glycogen occurs in prolonged peptic digestion. The final result is too low. A protest is entered against the incomplete and incorrect account of the Pflüger-Nerking method given in Salkowski's recently published text-book. A number of new experiments are given to show that this method is the best at present in vogue. W. D. H.

Estimation of Chloral Hydrate and Chloroform in Toxicological Analysis. By CARL KIPPENBERGER (*Arch. Pharm.*, 1900, 238, 81—100).—When chloral is distilled with an alkali, a not inconsiderable portion of the chloroform formed is decomposed according to the equation $\text{CHCl}_3 + 3\text{KHO} = 3\text{KCl} + 2\text{H}_2\text{O} + \text{CO}$. The author now estimates this carbon monoxide by taking advantage of its reducing action on palladium chloride.

The material to be tested is, if necessary, rendered faintly acid, then mixed with a fairly large quantity of magnesium oxide and introduced into a distilling flask placed in a water-bath. The flask is provided with a doubly-perforated cork, one opening of which is connected by means of an india-rubber tube and clamp with a Woulf's bottle containing aqueous caustic potash. This arrangement allows of the transmission of air later on. Through the other opening passes a tube connected with a small condenser which in turn is connected with another Woulf's bottle, then with a wash bottle containing dilute hydrochloric acid, and finally with a Lunge's 10-bulb tube filled

with solution of palladious chloride and surrounded by hot water; to this bulb tube an aspirator is attached to draw a current of air through the apparatus when no more chloroform distils over.

On heating the flask, the chloroform and water vapour condense in the Woulf's bottle and the chloroform is separated mechanically and weighed. The little which remains dissolved in the water is afterwards estimated by one of the well-known methods, for instance, by means of Fehling's solution, by potassium permanganate, or by iodine. The carbon monoxide, after being freed from volatile impurities by passing through the acid, now enters the bulb tube and causes a precipitate of metallic palladium, which is then collected, ignited and weighed. One hundred parts of palladium correspond with 26.42 parts of carbon monoxide or 156.02 of chloral hydrate or 112.6 parts of chloroform.

L. DE K.

Acidity of Milk. By A. L. TOURCHOT (*Expt. Stat. Record*, 1900, 11, 578; from *Brit. Food Jour.*, 1899, 1, 199).—Determinations of acidity in a large number of milk samples showed that fairly constant results are obtained with milk less than 12 hours old, the amount of *N/10* soda required to neutralise 10 c.c. of milk being 1.4—1.6 c.c. Greater acidity indicates that the milk is contaminated or less fresh, or else that it was from cows which had recently calved. Up to two weeks after calving, cows yield milk which may require as much as 1.8 c.c. of *N/10* soda to neutralise 10 c.c.

When the amount of soda required exceeds 1.7 c.c. in summer, or 1.6 c.c. when the cows are stall-fed, the milk should be rejected as unfit for food. On the other hand, acidity represented by less than 1.2 or 1.4 c.c. of *N/10* soda, in winter and in summer respectively, indicates addition of water or the presence of an unhealthy cow in the herd.

N. H. J. M.

Examination of Brown and Taylor's Official Method of Identifying Butter. By JOHN A. HUMMEL (*J. Amer. Chem. Soc.*, 1900, 22, 327—329).—In the manufacture of renovated butter, the butter-fat is melted and then rapidly cooled in a stream of cold water; this induces a semi-crystallisation of the fat, which may be recognised by the microscope. A small piece of the sample is placed on a glass slide and pressed into a thin film with a cover glass; it is then at once examined with a polarising microscope magnifying 120—150 diameters. A selenite plate is placed between the slide and the lower Nicol's prism. In every case normal butters gave a uniform blue coloured field showing the entire absence of crystals, but the renovated samples gave a blue field mottled with yellow, which varied in intensity, but was very distinct in each case.

L. DE K.

Maize Oil. By ROWLAND WILLIAMS (*Analyst*, 1900, 25, 146—147).—A table is given containing the sp. gr., potash-absorption, free fatty (oleic) acids, bromine thermal value, iodine values according to Hübl (15 hours) and to Wijs (15 minutes), and unsaponifiable matters of 8 samples of maize oil. On the whole, the figures are fairly constant, particularly those of the potash absorption and the bromine thermal value.

Notwithstanding its high iodine value (120·85—127·27), it possesses but little drying power and is not likely to take the place of linseed and similar oils in the manufacture of paints and varnishes.

L. DE K.

Nature of Klunge's Aloin Reactions, and the Oxidising Action of Cupric Salts in the Presence of Cyanogen Compounds. By EDUARD SCHAEER (*Arch. Pharm.*, 1900, 238, 42—48).—It is pointed out that a close analogy exists between Klunge's reactions for aloin and those of the author for guaiacum; the same substances (haloid salts, hydrocyanic acid, ferrocyanides, thiocyanates, and nitroprussides) which produce a blue coloration when added to a mixture of barbaloin and copper sulphate in dilute solution also produce the amethyst to cherry-red coloration when added to guaiacum-resin (guaiaconic acid) and copper sulphate. In both cases, the coloration is due to an oxidation of the colouring matter; it is removed by various reducing agents. (See also this vol., i, 512).

C. F. B.

Estimation of Santonin. By JULIUS KATZ (*Archiv Pharm.*, 1900, 238, 100—102. Compare Abstr., 1899, ii, 619; this vol., ii, 122).—A controversy with Thäter on the estimation of santonin in *Flores cinæ*. Whilst, doubtless, Thäter's improved process yields a fairly pure santonin, yet it is absolutely useless for quantitative purposes, as loss of 23—56 per cent. of the total amount of santonin is caused by it.

L. DE K.

Volumetric Estimation of Alkaloids. By OTTO LINDE (*Arch. Pharm.*, 1900, 238, 102—135. Compare Abstr., 1899, ii, 534, 826).—When titrating alkaloids with standard acid and alkali, it is advisable to avoid an excess of the indicator, to have the solution as concentrated as possible, and to work at the ordinary temperature.

The following indicators may be used; they are classed according to their sensitiveness: Iodeosin, in water covered with ether; fluorescein and gallein, in water, covered with ether or in alcohol; luteol, in water or alcohol (ether or chloroform to be avoided); phenacetolin, in alcohol or water; lacmoid, in alcohol, less satisfactory in water with or without addition of ether; cochineal, in water or alcohol; tincture of brazilwood, tincture of logwood, hæmatoxylin, brazilin, azolitmin, and litmus, in water; phenolphthalein, in water (ether and chloroform to be avoided); rosolic acid, in water (ether and chloroform to be avoided); Congo-red (ether to be avoided); methyl-orange, in water; dimethyl-aminoazobenzene, in water (ether, alcohol, and light petroleum to be avoided); tropæolin, in water; tincture of turmeric and Poirrier's blue are useless.

L. DE K.

Estimation of Alkaloids by Means of a Titrated Solution of Iodine. By CARL KIPPENBERGER (*Arch. Pharm.*, 1900, 238, 135—148. Compare Abstr., 1895, ii, 467; 1896, ii, 282, 682).—A lengthy reply to Scholtz's criticism (Abstr., 1899, ii, 390). The author, although aware that the iodine process for the estimation of alkaloids does not belong to the more accurate analytical methods, still recommends it for practical purposes. Besides repeating previous experiments, fresh ones have been made with caffeine and aconitine; a solution of silver

iodide in potassium iodide is recommended as a catalytic liquid to promote the action of the iodine.

L. DE K.

[Estimation of Berberine.] By JULIUS TROEGER and OTTO LINDE (*Arch. Pharm.*, 1900, 238, 4—8).—See this vol., i, 515.

Gluten Constituents of Wheat and Flour, and their Relation to Bread-making Qualities. By H. A. GURRS (*J. Amer. Chem. Soc.*, 1900, 22, 263—268).—The following method of analysis is proposed :—
(a) Five grams of the finely-ground meal or flour are put into a 250 c.c. flask, and a 1 per cent. solution of salt is added from a pipette with sufficient pressure to prevent any tendency to clot; the flask is then filled to the mark, shaken at intervals for an hour, and left at rest for 2 hours. Of the clear filtrate, two duplicate portions of 100 c.c. are withdrawn, the proteids are precipitated with a few c.c. of a 10 per cent. solution of phosphotungstic acid, 50 c.c. of the clear filtrate evaporated with sulphuric acid, and the amide-nitrogen estimated in the usual manner.

(b) One gram of the sample is put into a 500 c.c. Kjeldahl flask, mixed with alcohol of sp. gr. 0.90, thoroughly shaken, placed in a water-bath maintained at a temperature slightly below the boiling point of the alcoholic mixture, and agitated every 10 minutes for an hour. After settling for an hour, the liquid is poured as far as practicable into a similar flask, taking care not to disturb the deposit; this is then treated four times in succession with 25 c.c. of hot alcohol to complete the extraction. The alcohol is distilled off, the nitrogen in the residue estimated, the amide-nitrogen subtracted, and the balance calculated to gliadin, using the factor $\times 5.7$.

(c) The residue from the alcohol extraction, when cold, is treated with 250 c.c. of a 1 per cent. solution of salt, and allowed to settle for an hour; after pouring off the liquid through a filter, the mass is again treated with another 250 c.c. of salt solution, shaken at intervals for an hour, and allowed to settle for 2 hours, when the liquid is decanted through the same filter. The filter and contents are added to the residue in the flask, and the nitrogen estimated and calculated to glutenin.

The results of the analyses of 104 samples are communicated in a table. At present, it cannot be said that there seems to be a true relation between the ratios of the various proteids and the practical value of the sample for bread making, but there is no doubt a direct and very intimate connection between them.

L. DE K. /

General and Physical Chemistry.

Origin of Certain Unknown Lines in the Spectra of Stars of the β -Crucis Type, and the Spectrum of Silicon. By JOSEPH LUNT (*Proc. Roy. Soc.*, 1900, 66, 44—50).—The three unknown lines present in the spectra of β -Crucis, ϵ -Canis Majoris, and stars of that type (Gill, *Abstr.*, 1899, ii, 718), have been obtained from pure helium and argon tubes with a highly disruptive spark, and are shown to be due to silicon. In the silicon spectrum from these tubes, the enhanced lines noted by Lockyer are less prominent than in the spectrum obtained from silicon tetrafluoride with an intensely disruptive spark; it therefore seems that great variations in the relative intensities of the silicon lines occur in stellar spectra. This behaviour of the silicon lines is important in the determination of relative stellar temperatures (compare Lockyer, this vol., ii, 181). J. C. P.

Liquid Absorption Spectra in the Ultra-Red. By L. PUCCIANI (*Nuovo Cimento*, 1900, [iv], 11, 241—278).—The absorption spectra of the following liquids in the ultra-red have been determined for wave-lengths of 2.75μ and less: Benzene, toluene, *o*-, *m*-, and *p*-xylene, ethylbenzene, methyl iodide, ethyl iodide, ether, alcohol, methyl alcohol, pyridine, allyl alcohol, carbon disulphide, and carbon tetrachloride. The results, together with those of Donath (*Ann. Phys. Chem.*, 1896, [ii], 58, 609), on oil of turpentine, oil of juniper, oil of rosemary, oil of lavender, safflower oil, oil of olives, and petroleum show that liquid compounds whose molecules contain carbon combined directly with hydrogen exhibit a maximum of absorption for the wave-length 1.71μ . Further, besides this maximum, all the benzene compounds examined, and also pyridine, have two other maxima of absorption in common, these being probably due to the peculiar structure of their molecules. The spectra of the three alcohols are very similar, and have maxima of absorption for a wave-length of about 2.10μ . The three isomeric xylenes show absorptions almost, although not quite, identical. At about 2.32μ , another maximum occurs for toluene, *o*-, *m*-, and *p*-xylene, ethylbenzene, ethyl iodide, ether, and methyl and ethyl alcohols. T. H. P.

Sensitiveness of Silver and of some other Metals to Light. By JAMES WATERHOUSE (*Proc. Roy. Soc.*, 1900, 66, 490—504).—The author confirms Moser's observation that silver, exposed under ordinary conditions, is distinctly sensitive to light; not only can an invisible, developable image be obtained, but by prolonged exposure printed-out impressions are produced which are clearly visible after exposure. Blue and violet rays are shown to be most active in producing this effect. It seems that heat does not play any active part in the production of the images, although higher temperatures may accelerate the action of light. When a pure silver plate has been raised to a red heat, plunged in dilute sulphuric acid, washed,

dried, and exposed, no image is produced. Of other metals, the only one that is similarly sensitive is lead. J. C. P.

Artificial Radio-active Barium. By A. DEBIERNE (*Compt. rend.*, 1900, 131, 333—335).—When a highly radio-active salt of actinium is added to a barium chloride solution, the latter becomes radio-active, and the results are more marked if the barium is precipitated as sulphate and reconverted into chloride, the actinium being separated by means of ammonium hydroxide. The radio-activity of the barium increases with the duration of its contact with the actinium salt, and may become several hundred times as great as that of uranium. The radiation thus induced in the barium resembles that of the radio-active barium obtained from pitchblende, is associated with the atoms of the metal, and persists through various chemical changes; it ionises gases, excites the phosphorescence of barium platinocyanide, and acts on photographic plates. Part of the radiation is deflected in a magnetic field, and the anhydrous chloride of the metal is self-luminous. Further, the barium chloride made radio-active by induction can be fractionated, and the radio-activity is more intense in the first crystals. On the other hand, the salts do not show the spectrum of radium, and the induced radio-activity gradually diminishes in intensity (compare this vol., ii, 351, 352, 480). C. H. B.

Spectrum of Radium. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1900, 131, 258—259).—A specimen of radium chloride, prepared by Mme. Curie, and dissolved in hydrochloric acid, gave a spark spectrum in which the barium lines were feeble, and only the line 4554·4 had any marked intensity. On the other hand, it gave a brilliant radium spectrum, which did not contain any lines in addition to those already observed (this vol., ii, 83). Two bands described (*loc. cit.*) as faint and nebulous were, however, very distinct, with maximum intensity at about 4627·5 and 4455—4453·4 respectively. The line 4364·2, formerly attributed to radium, seems to be identical with the platinum line 4364·4, and the origin of the very feeble line 4600·3 is uncertain. In general character, the radium spectrum resembles the spectra of the alkaline-earth metals. The low intensity of the barium spectrum indicates that this specimen of radium chloride is practically pure. C. H. B.

Radio-activity of Uranium. By SIR WILLIAM CROOKES (*Proc. Roy. Soc.*, 1900, 66, 409—423).—In agreement with an observation of M. and Mme. Curie (this vol., ii, 82), the author finds that all radio-active minerals contain either uranium or thorium; pitchblende shows the most intense action, and gives an effect roughly proportional to the percentage of uranium it contains. In the preparation of pure uranium nitrate, it was observed (1) that solution of the nitrate in ether and subsequent crystallisation gave an inactive product; (2) that the active constituent was concentrated in the aqueous layer formed when crystallised uranium nitrate and ether are shaken up together. The portion insoluble in ether, when evaporated to dryness with nitric acid and crystallised from water, has the same appearance (1) as ordinary uranium nitrate, (2) as the product from the ethereal solution, evapo-

rated to dryness and crystallised from water. When the uranium nitrate from the portion insoluble in ether is submitted to fractional crystallisation, the radio-active substance is concentrated in the mother liquor. A highly active uranium nitrate obtained in this way was dissolved in water, and excess of ammonia added; the whole of the radio-activity was found to reside in the ammonium uranate formed. Another portion of active uranium nitrate was dissolved in water, and excess of ammonium carbonate added; the first formed precipitate almost entirely redissolved, but a light brown, fluorescent portion, remaining insoluble in excess, was found to contain almost the whole of the radio-active constituent. For this the author uses provisionally the symbol UrX , and shows that its action differs from that of polonium, inasmuch as the emanations from the latter cannot pass through glass, aluminium, or lead. UrX is further distinguished from polonium by its non-volatility and its chemical behaviour. It is not so easy to settle whether UrX is distinct from radium, although many considerations point to its not being this substance; thus radium sulphate is said to be insoluble in water and acids, whilst UrX dissolves easily to a clear solution in dilute sulphuric acid.

Similar experiments with thorium nitrate point to the possibility of separating a radio-active substance from thorium. J. C. P.

Behaviour of Radium at Low Temperatures. By O. BEHRENDSEN (*Ann. Phys.*, 1900, [iv], 2, 335—337).—The power of certain substances possessing radio-activity to discharge a metallic conductor has been previously shown (*Ann. Phys. Chem.*, 1896, [ii], 69, 220) to be diminished by lowering the temperature. The same behaviour has now been observed in the case of a radium preparation. J. C. P.

Velocity of the Ions produced in Gases by Röntgen Rays. By JOHN ZELENY (*Proc. Roy. Soc.*, 1900, 66, 238—241).—The author has determined the velocities of the ions produced in air, oxygen, carbon dioxide, and hydrogen by Röntgen rays. Moisture generally diminishes the ionic velocity, this effect being specially marked in the case of negative ions. Except for moist carbon dioxide, the velocity of the negative ion is greater than that of the positive ion (compare Rutherford, *Abstr.*, 1898, ii, 112; Townsend, *Abstr.*, 1899, ii, 729).

J. C. P.

Electrical Conductivity in Gases traversed by Cathode Rays. By J. C. McLENNAN (*Proc. Roy. Soc.*, 1900, 66, 375—378).—It has been shown that when a gas is traversed by Röntgen or uranium rays, positive and negative ions are produced; the author finds that this occurs also under the influence of cathode rays. When cathode rays of a given strength pass through a gas, the number of ions produced per second in 1 cub. cm. depends only on the density of the gas, and is independent of its chemical composition. Under rays of constant intensity, the ionisation in a particular gas varies directly as the pressure. It is shown that the values of relative ionisation in different gases by Röntgen rays of constant intensity agree well in most cases with those obtained for cathode rays.

J. C. P.

Electrical Effects due to Evaporation of Sodium in Air and other Gases. By W. CRAIG HENDERSON (*Proc. Roy. Soc.*, 1900, 66, 183—186).—When sodium is fused and boiled in an iron cylinder, an electrometer connected (1) with the cylinder, (2) with a copper plate suspended in the vapour, shows considerable electrification; this, however, is not observed when the air in the cylinder is replaced by coal gas, so that the electrification is due to oxidation, and not merely to evaporation.

J. C. P.

Electrolytic Reduction of Difficultly Reducible Substances in Sulphuric Acid Solution. By JULIUS TAFEL (*Zeit. physikal. Chem.*, 1900, 34, 187—228; also *Ber.*, 1900, 33, 2209—2224).—By comparing the volumes of hydrogen liberated (1) in a sulphuric acid voltameter, (2) at the cathode of a cell containing a reducible substance in sulphuric acid solution, it is possible to follow the course of the reduction. With an apparatus constructed on this principle, the author has determined under what conditions the process of reduction is a regular one. In the case of caffeine, the reducible substance mainly used in the experiments, no reduction takes place except when the cathode is of lead or mercury, the cathode potential of these metals being specially high. The addition of small quantities of other metals to the cathode liquid stops the reduction process, and there is a simultaneous fall in the cathode potential. In certain cases, the foreign metal is rendered harmless, and the reduction process started again by the addition of lead acetate. In view of these experiments, it is probable that the irregularities usually observed in the reduction process are due to small quantities of foreign metals. To obtain consistent results, it is further necessary that the lead electrodes should be prepared electrolytically, and have a superficial coating of finely divided peroxide. Rise of temperature accelerates the reduction of caffeine, but only to a small extent (compare Abstr., 1899, i, 268).

J. C. P.

Chromium Cell for the Rectification of Alternating Currents. By J. LIVINGSTON R. MORGAN and W. A. DUFF (*J. Amer. Chem. Soc.*, 1900, 22, 331—334).—Two electrodes, one of chromium and the other of platinum, are immersed in dilute sulphuric acid. When the platinum is made the anode, the current passes freely; but if the chromium is made the anode, no current goes through the cell. By using the chromium as anode and very gradually increasing the impressed E.M.F., it is possible to stop any current entirely until a pressure of about 75 volts is reached. When the increase in the E.M.F. is made so rapidly that the current passes from chromium to platinum, or after the cell breaks down by the application of more than 75 volts, a peculiar result is obtained. Unlike the aluminium cell, the chromium cell, after it has broken down, is still an asymmetrical resistance, but only when the platinum plate is made the anode. With chromium as the anode, the current now passes freely. If in this condition the cell is broken down by the application of too high an E.M.F. to the platinum anode, another reversal takes place, so that about 75 volts can again be stopped, using the chromium as anode. This change in the behav-

our of chromium is doubtless due to the change from the 'active' to the 'inactive' state (Hittorf, *Abstr.*, 1898, ii, 363; 1900, ii, 127).

The authors consider that these results confirm the theory that the action of the aluminium cell is due to the formation of a resistant film, as suggested by Norden (this vol., ii, 404; compare also Wilson, *Abstr.*, 1899, ii, 540). E. G.

Existence of Thermal Centres of Stability in Compounds. By GEOFFREY MARTIN (*Chem. News*, 1900, 81, 301—304).—The heat of formation of a compound varies with the temperature, and the kinetic theory leads to the conclusion that for an exothermic compound the heat of formation diminishes as the temperature rises. Victor Meyer has shown that the heat of formation of hydrogen iodide is at first negative, becomes zero at 324° , and at higher temperatures is positive; an example of an endothermic compound changing into an exothermic one. The author supposes that this is a general phenomenon, and that the exothermic compound may pass back again to the endothermic stage as the temperature rises. According to this view, the positive or negative value of the heat of formation is a periodic function of the temperature. Each temperature at which the heat of formation is zero would be a centre of stability. It is not to be expected that a gaseous substance would exist at all points on this curve, but it should exist at least at the centres of stability. The author discusses evidence in favour of this, and points out, *inter alia*, that silicon hexachloride, which at 800° is completely dissociated into tetrachloride and silicon, exhibits no dissociation if suddenly raised above 1000° . This compound, therefore, is stable above 1000° and below 350° , but cannot exist undissociated at intermediate temperatures. The maximum of conductivity shown by certain acids in solution is regarded as an analogous phenomenon. J. C. P.

Weight of Hydrogen Desiccated by Liquid Air. By LORD RAYLEIGH (*Proc. Roy. Soc.*, 1900, 66, 334).—The density of hydrogen dried by liquid air, acting as a cooling agent, is the same as that obtained when phosphoric oxide is used to effect desiccation. J. C. P.

Distillation of Liquid Air, and the Composition of the Gaseous and Liquid Phases. I. At Constant Pressure. By EDWARD C. C. BALY (*Phil. Mag.*, 1900, [v], 49, 517—529).—The experiments were made in order to render possible the determination of the temperature of boiling air by the analysis of the gas evolved. The results are summed up in two curves which show (1) the boiling point at 760 mm. of all mixtures of oxygen and nitrogen, (2) the temperature at which any mixture of oxygen and nitrogen will liquefy, and the composition of the liquid formed. When $r'/100$ is the ratio of the compounds in the gaseous phase, and $r/100$ the corresponding ratio in the liquid phase, then the most probable relation between r and r' throughout the distillation is found to be $r' = 0.2097 \times r^{1.03757}$ (compare Leffeldt, *Phil. Mag.*, 1895, [v], 40, 397). There does not appear to be any connection between the ratio of the vapour pressures and the composition of the gaseous phase in the distillation of oxygen and nitrogen at constant pressure. J. C. P.

Viscosity of Argon as affected by Temperature. By LORD RAYLEIGH (*Proc. Roy. Soc.*, 1900, 66, 68—74).—The time of passage of a quantity of argon through a capillary tube has been determined at two different temperatures. It was thought probable that the viscosity of argon would vary with the temperature in another manner than that of the diatomic gases, oxygen, hydrogen, and nitrogen, but the experimental work shows that there is no great difference. When $\mu'/\mu = [\theta'/\theta]^n$, where μ' and μ are the viscosities at the absolute temperatures θ' and θ , then n has the following values: air (dry), 0.754; oxygen, 0.782; hydrogen, 0.681; argon (impure), 0.801; argon (best), 0.815. J. C. P.

Influence of the Medium on the Velocity of Reaction. By GUSTAV BUCHBÖCK (*Zeit. physikal. Chem.*, 1900, 34, 229—247).—A previous investigation (*Abstr.*, 1897, ii, 398) has shown that the velocity of decomposition of carbonyl sulphide in various aqueous solutions depends partly on the viscosity of the solutions. This investigation has now been amplified on the basis of van't Hoff's theory, according to which the velocity of reaction in various media is defined by the equation $dC/dt = \kappa C/S$; here C is the concentration, and S represents the quantities of the reacting substance (carbonyl sulphide) which are in equilibrium with each other in the various media. The author has taken isosmotic solutions of a number of salts and acids, and determined the absorption coefficient and decomposition velocity constant of carbonyl sulphide in these solutions; he has further measured the viscosity of the solutions. In general it is seen that the greater the viscosity the smaller the value of κ . The product of the two has for inorganic solutions a fairly constant value (8.84), quite different, however, from the value obtained in the case of the organic acids. It is pointed out that the product of reaction velocity and viscosity is a linear function of the absolute quantity of water in the solutions; if allowance is made for this, it is seen that the velocity of decomposition of thiocarbonic acid in such aqueous isosmotic solutions as are in equilibrium with respect to thiocarbonic acid, is inversely proportional to the viscosity of the solutions. J. C. P.

Reply to Criticism. [Chemical Affinity.] By WILHELM VAUBEL (*Chem. Zeit.*, 1900, 24, 371—373).—A recapitulation of the author's theories (see this vol., ii, 264, 274), and a reply to Küster's criticisms in particular. J. C. P.

Affinity Constants of Acids containing a Ring of Seven Carbon Atoms. By W. A. ROTH (*Ber.*, 1900, 33, 2032—2035. Compare Willstätter, *Abstr.*, 1899, i, 651).—The following affinity constants in absolute units at 25° have been determined: α -Cycloheptatrienecarboxylic acid (α -isophenylacetic acid), $K = 0.003672$; β -cycloheptatrienecarboxylic acid (β -isophenylacetic acid), $K = 0.004101$; Δ^1 -cycloheptenecarboxylic acid, $K = 0.000992$ and for another solution, after correcting for the conductivity of the water, $K = 0.000928$. Δ^2 -Cycloheptenecarboxylic acid gave, in three different solutions, the corrected values $K = 0.00267$, 0.00260 and 0.002606 respectively; this acid appears to undergo a gradual chemical change resulting in a

diminution of the value of K , the highest number for which is hence probably the most accurate.

T. H. P.

Nature and Properties of Colloidal Solutions. By GIUSEPPE BRUNI and N. PAPPADÀ (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 354—358).—Solutions of the following colloids—silicic acid, ferric hydroxide, chromic hydroxide, ferric ferrocyanide, egg albumin, and gelatin—were prepared and submitted to dialysis for varying periods, never less than a fortnight, the external liquid being frequently changed. In no case was any of the colloid found to diffuse through the dialyser, and further, the freezing points of the colloidal solution and of the external liquid with which it is in equilibrium show only very small differences, which are in both senses and within the limits of experimental error. Vapour tension experiments, carried out by a modification of Ostwald and Walker's method, a current of air being passed through a series of five flasks, the first three containing the colloidal solution, and the others the corresponding exterior liquid from the dialysing apparatus, showed no variation in the vapour pressures of the various liquids. Semi-colloids, for example, dextrin or molybdic acid, in solution pass comparatively readily through a dialyser and also give small depressions of the freezing point, which are, however, quite appreciable and proportional to the concentration; dextrin, for example, gives a molecular weight 1135, corresponding with the formula $(C_6H_{10}O_5)_7$. Semi-colloids must hence be regarded as substances which, in solution, have very high molecular weights. With colloids, however, no real solution takes place, the substance remaining suspended in the liquid in a very fine state of subdivision. This view finds confirmation in the application of the phase rule to such solutions. If they are true solutions, on freezing there would be three co-existent phases—ice, solution, and vapour—the system being mono-variant, whilst in the case of a solution containing a solid in suspension, there would be another phase and the system would be non-variant. That the latter is the fact is shown by the constancy of the temperature of freezing, which in the former case would vary with the concentration. This conclusion is in accord with that of Stoeckel and Vanino (this vol., ii, 11), arrived at from a study of the optical properties of colloidal solutions of the metals.

T. H. P.

Nitrogen Peroxide as a Solvent. By GIUSEPPE BRUNI and P. BERTI (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 321—326).—The cryoscopic behaviour of solutions of the following compounds in nitrogen peroxide has been examined: nitromethane, nitroethane, acetic, butyric, trichloroacetic, picric, and nitric acids. Nitromethane, nitroethane, and picric acid show normal molecular weights, whilst all the other compounds examined show depressions of the freezing points less than the normal, hence nitrogen peroxide is not only devoid of dissociating power but must be classed with those solvents in which hydroxy-compounds are associated.

T. H. P.

Cryoscopic Behaviour of Nitro-derivatives in Formic Acid. I. By GIUSEPPE BRUNI and P. BERTI (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 273—279).—The cryoscopic behaviour of the

following nitro-derivatives in formic acid has been determined: Nitrobenzene, *m*-dinitrobenzene, 1:3:5-trinitrobenzene, 2:4:6-trinitrotoluene, 1-chloro-2:4:6-trinitrobenzene, picric acid, methyl picrate, *p*-nitrobenzoyl chloride, nitromethane, nitroethane, chloropicrin. The results show that the aromatic nitro-derivatives are all more or less dissociated in formic acid solution, whilst those of the aliphatic series show no signs of dissociation. Picric acid is not more dissociated than its methyl ether, the presence of the hydroxyl group being apparently without effect on the dissociation, which, however, tends to increase with the accumulation of electro-negative groups in the molecule. The presence of a small quantity of water in the formic acid does not increase its dissociating power.

This dissociation of aromatic nitro-derivatives in formic acid solution is probably due to the formation of an additive product of the type $R \cdot NO(OH)(CO_2H)$. Such compounds would be capable of dissociation and similar additive products should also be formed with acetic acid, but in this case they are not indicated by the cryoscopic behaviour, since acetic acid has no dissociating power. One fact in favour of this hypothesis is that solutions of aromatic polynitro-derivatives in anhydrous formic acid are colourless even at high concentrations, whilst with other solvents, whether possessed of dissociating power or not, they form intensely yellow solutions. T. H. P.

Behaviour of Nitro-derivatives in Formic Acid Solution. II. By GIUSEPPE BRUNI and P. BERTI (*Atti Real Accad. Lincei*, 1900, [v], 9, i, 393—400).—In formic acid solution, the following nitro-compounds all show abnormally small molecular weights on freezing: trinitro-*p*-xylene, *o*-, *m*-, and *p*-chloronitrobenzenes, *o*-, *m*-, and *p*-nitrobenzoic acids, methyl *o*-, *m*-, and *p*-nitrobenzoates.

The molecular weights of *s*-trinitrobenzene, 2:4:6-trinitroanisole, dinitromesitylene and trinitromesitylene were determined in boiling formic acid, the last two compounds being almost insoluble in the freezing acid. The molecular raising of the boiling point of formic acid is $\kappa = 34$, as determined for solutions of β -naphthol and benzoic acid. Of the four compounds mentioned, the first three show marked dissociation in boiling formic acid, whilst trinitromesitylene gives the normal molecular weight, whence the conclusion is drawn that for a compound to show dissociation in formic acid solution the presence of a mobile hydrogen atom in the molecule is necessary.

To test the hypothesis advanced in a former paper (see preceding abstract), according to which dissociation in formic acid is due to the formation of an additive product of the acid with the dissolved substance, the freezing point curve for mixtures of formic acid and *o*-chloronitrobenzene was studied. The curve is composed of two branches meeting in one cryohydric point, as is the case for mixtures of two substances which do not combine, and completely excludes the existence of an additive compound. T. H. P.

Oxidations with Free Oxygen. By WILHELM OSTWALD (*Zeit. physikal. Chem.*, 1900, 34, 248—252).—The occurrence of ozone in oxidation processes has been attributed to the primary formation of a higher oxide of the oxidisable substance, which then splits up into a

lower oxide and ozone. The author deals with the theoretical side of this view, and points out that ozone has a higher oxidation potential than the oxygen from which it is derived, and that the energy necessary to raise the oxidation potential must be obtained from some other reaction, namely, the formation of a more stable oxide. These two processes, however, must be intimately connected with one another, and expressible by a single chemical equation with definite integral coefficients. Thus, when ozone occurs in the oxidation of phosphorus, it is incorrect to suppose that (1) energy is derived from the oxidation of the phosphorus, (2) this energy converts oxygen into ozone, the two processes being independent; on the contrary, they must be intimately related, and this is done by postulating the intermediate formation of a higher oxide. The criterion for the formation of such an intermediate compound is the occurrence of the final products in definite chemical proportions.

J. C. P.

Crystallographic Characters of some Isomorphous Potassium Salts. By F. CORIO (*Zeit. Kryst. Min.*, 1900, 32, 524—526; from *Atti Soc. Sci. Nat. Modena*, 1898, 16, 73—117).—Optical and crystallographic determinations are given of potassium sulphate and potassium chromate and of crystals containing various proportions of these two salts.

L. J. S.

Comparative Crystallographical Study of the Double Selenates of the Series $R_2M(SeO_4)_2 \cdot 6H_2O$. I. Salts in which M is Zinc. By ALFRED E. TUTTON (*Proc. Roy. Soc.*, 1900, 66, 248—250).—In the double salts examined, R represents potassium, rubidium, and caesium. The characters of the rubidium double selenate lie invariably between those of the potassium and caesium salts. Comparison of the results obtained with those previously communicated (*Trans.*, 1893, 63, 337; 1896, 69, 344), shows that the replacement of sulphur by selenium is generally accompanied by a change in the morphological and physical constants similar to that accompanying the replacement of one alkali metal by another of higher atomic weight. In the heavier selenate molecules, however, the amount of change caused by varying the alkali metal is often less than in the case of the double sulphates.

J. C. P.

Acetylene Gas as Fuel in Chemical Laboratories. By ARTHUR LACHMAN (*Amer. Chem. J.*, 1900, 24, 39—45).—The author thinks that, in cost, convenience, or feasibility, acetylene cannot compete with "gasoline gas" (air saturated with gasoline vapour) as a laboratory fuel.

J. J. S.

Etymological Researches on the Names of the Chemical Elements, from which the International and National Symbols are derived, with Special Reference to the German Names. By PAUL DIERGART (*J. pr. Chem.*, 1900, [ii], 61, 497—531).—An etymological paper, which traces the derivation of the common names of the elements and throws much light on their history.

R. H. P.

Inorganic Chemistry.

Electrolysis of Concentrated Hypochlorite Solutions. By ANDRÉ BROCHET (*Compt. rend.*, 1900, 131, 340—343).—When a solution of sodium hypochlorite containing sodium hydroxide is electrolysed, the proportion of hypochlorite at first diminishes rapidly, and afterwards more slowly, finally becoming constant. At the same time, the proportion of chlorate increases, at first very rapidly, then more slowly, and afterwards at a constant rate. The reduction at the cathode is almost constant for some time, then diminishes somewhat rapidly, and afterwards becomes constant again; the oxidation at the anode is at first constant, then increases slowly, and finally reaches a limit. The presence of sodium hydroxide does not affect the reduction of the hypochlorite, but very materially affects the limits of the reactions. C. H. B.

Composition of Nitrogen Iodide. By F. D. CHATTAWAY (*Amer. Chem. J.*, 1900, 24, 138—158).—See *Proc.*, 1899, 15, 18.

Action of Light on Nitrogen Iodide. By F. D. CHATTAWAY and K. J. P. ORTON (*Amer. Chem. J.*, 1900, 24, 159—167).—See *Proc.*, 1899, 15, 18.

Transformation of Hyponitrous Acid into Hydrazine. By FREIHERR VON BRACKEL (*Ber.*, 1900, 33, 2115—2116).—An acid aqueous solution of hyponitrous acid was treated with sodium hydrogen sulphite in the cold; the product reduced Fehling's solution in the cold. It was concentrated under diminished pressure and reduced with zinc dust and acetic acid; the solution, when freed from zinc, reduced Fehling's solution in the cold, and gave a precipitate of benzalazine with benzaldehyde; it must therefore have contained hydrazine. O. F. B.

Nitrohydroxylaminic Acid. By ANGELO ANGELI and FRANCESCO ANGELICO (*Gazzetta*, 1900, 30, i, 593—595).—The *potassium*, $K_2N_2O_3$, *calcium* (with $\frac{1}{2}H_2O$), *strontium* (with H_2O), *lead*, and *cerium*, $Ce_2(N_2O_3)_3 \cdot Ce(OH)_3$, salts of nitrohydroxylaminic acid have been prepared. Solutions of the sodium salt rapidly absorb oxygen from the air, forming sodium nitrite, which in presence of excess of the nitrohydroxylamine partially undergoes further oxidation to nitrate. Nitrohydroxylaminic acid, which is unstable and could not be isolated, decomposes in various ways depending on the conditions; by means of acids it is broken up almost quantitatively according to the equation: $H_2N_2O_3 = 2NO + H_2O$, small quantities of nitrous and possibly of hyponitrous acid also being formed. On boiling the sodium salt with water, one half of the total nitrogen is evolved in the form of nitrous oxide and the rest remains as sodium nitrite, $2H_2N_2O_3 = 2HNO_2 + N_2O + H_2O$; this reaction indicates the structure $O:N(OH):N \cdot OH$.

for the acid. On heating the sodium salt to incipient fusion, sodium nitrite and hyponitrite are formed thus : $2\text{O}:\text{N}(\text{OH})\text{:N}\cdot\text{OH} = 2\text{HNO}_2 + \text{OH}\cdot\text{N}:\text{N}\cdot\text{OH}$. The aqueous solution of the sodium salt readily reacts with aldehydes with development of heat; with acetaldehyde, the sodium salts of nitrous and acetohydroxamic acids are formed. T. H. P.

Solubility of Quartz in Sodium Silicate Solutions. By GIORGIO SPEZIA (*Atti Accad. Sci. Torino*, 1900, 35, 750—761).—Dilute solutions of sodium silicate acting on quartz at high temperatures exert a decided solvent action on it. At lower temperatures, the quartz is re-deposited, Sterry Hunt's hypothesis that such deposition is due mainly to diminution in pressure being in this case untenable. T. H. P.

Constitution of Glass and Allied Products. By KARL ZULKOWSKI (*Chem. Centr.*, i, 1041—1042; from *Chem. Ind.*, 1900, 23, 108—114).—Like silicic acid, boric acid forms higher poly-acids of the type $\text{B}_{2n}\text{O}_{3n-1}(\text{OH})_2$ or $n\text{B}_2\text{O}_3, \text{H}_2\text{O}$. When melted with alkali carbonates, it behaves like silicic acid, and with excess of the carbonate tends to form a metaborate, hence in boron glass probably only polymetaborates are present. Compounds of borosilicic acid probably occur in silicate glass containing boric acid.

When silicate glass is rendered opaque by adding tin dioxide, polymetastannates which are less fusible and are insoluble in the fused mass are formed. The opaque particles of enamel glass probably also consist of these compounds. Whilst, however, polymetastannates of the type $\text{KO}\cdot\text{SnO}\cdot\text{O}\cdot\text{SnO}\cdot\text{OK}$ are formed by fusing tin dioxide with potassium carbonate, the ordinary metastannate, $\text{SnO}(\text{ONa})_2$ is obtained with sodium carbonate; the production of normal or acid stannates seems to be less dependent on the kind of alkali than on the melting point.

Unlike the anhydrides of the other glass-forming acids, calcium metaphosphate, when melted with potassium carbonate, forms an orthophosphate. The composition of pure phosphate glass corresponds with that of silicate glass, and the polymetaphosphoric acids formed are of the type $\text{P}_{2n}\text{O}_{3n-1}(\text{OH})_2$ or $n\text{P}_2\text{O}_5, \text{H}_2\text{O}$. Calcium metaphosphate is prepared by gradually heating and then melting crystallised monocalcium orthophosphate at an orange-red heat. E. W. W.

So-called Electrolytic Silver Peroxide [Silver Peroxynitrate. By OTTOKAR ŠULC (*Zeit. anorg. Chem.*, 1900, 24, 305—313. Compare Abstr., 1896, ii, 521).—The compound $\text{Ag}_2\text{NO}_{11}$, obtained by the electrolysis of a solution of silver nitrate, has been subjected to further investigation. When dissolved in ammonia, it liberates 2·8 per cent. of nitrogen, that is, 2 mols. of ammonia are oxidised by 3 of the oxygen atoms of the peroxide. When heated at 120° during 16 hours, it decomposes, evolving 8·46 per cent., or 5 atomic proportions of oxygen, whilst at lower temperatures the decomposition is slower, and does not proceed so far. From these results, the author proposes the formula $\text{AgNO}_3, 3\text{Ag}_2\text{O}_2, 2\text{O}$ for the substance (compare Mulder and Heringa, *loc. cit.*). E. C. R.

Manganese Compounds. I. Ammonium Permanganate.

By ODIN T. CHRISTENSEN (*Zeit. anorg. Chem.*, 1900, 24, 203—219).—Ammonium permanganate can be prepared by the action of ammonium chloride on potassium permanganate solution at 70—80°, or on finely-powdered silver permanganate, and purified by recrystallisation from water at 70°. When left in a closed vessel at the ordinary summer temperature, it is completely decomposed with the formation of ammonium nitrate and the insoluble manganese oxide, $22\text{MnO}_2, \text{MnO}, x\text{H}_2\text{O}$, crystallised in pseudomorphs of ammonium permanganate. At higher temperatures (42—50°), a similar decomposition takes place in a few days, whilst at 58° the salt decomposes in a few hours with explosive violence. The same compounds are obtained, together with a small quantity of nitrogen, on boiling the substance with water, whilst when it is heated with ammonia, the decomposition products are nitrogen, ammonium nitrite, a small quantity of ammonium nitrate, and a hydrated manganese oxide, which, after drying, contains 85.31 per cent. of manganous oxide and 14.69 per cent. of active oxygen. When heated with nitric acid, the hydrated manganese oxide $22\text{MnO}_2, \text{MnO}, 28\text{H}_2\text{O}$ is formed, containing, however, a small quantity of ammonia which cannot be eliminated. E. C. R.

Ferrous Iodide. By C. LORING JACKSON and I. H. DEEBY (*Amer. Chem. J.*, 1900, 24, 15—31).—Ferrous iodide was prepared by heating clean iron wire clippings in an atmosphere of nitrogen saturated with iodine vapour. The product forms deep red plates with a slightly brownish tinge, but in thicker masses is nearly black; it is extremely deliquescent, decomposes at a moderate heat in the presence of oxygen, and when exposed in a desiccator it turns white, but then gradually evolves iodine and becomes grey or black. The white compound is probably a hydrate, $\text{FeI}_2 \cdot 2\text{H}_2\text{O}$. Carius and Wanklyn's (*Annalen*, 1861, 120, 69) and Thomson's (*Compt. rend.*, 1862, 55, 615) methods for the preparation of ferrous iodide have also been tried, and the product obtained in each case had the appearance just described.

Anhydrous ferrous iodide readily absorbs ammonia gas, yielding a voluminous, white, amorphous powder of the composition $\text{FeI}_2 \cdot 6\text{NH}_3$, which is readily decomposed by water, and, when treated with bromine vapour, yields ferric bromide, ammonium bromide, and ammonium bromiodobromide, NH_4BrIBr . This compound, which may also be obtained by the action of an ethereal solution of iodine bromide on ammonium bromide, is a lustrous green substance, dissolves in ether, and readily decomposes when exposed to the air, leaving a residue of ammonium bromide. J. J. S.

Action of Potassium Persulphate on Cobalt Salts. By F. MAWROW (*Zeit. anorg. Chem.*, 1900, 24, 263—268).—A solution of cobalt sulphate or nitrate, when warmed with excess of potassium persulphate, yields a dark brown precipitate containing $\text{Co}_3\text{O}_4 \cdot 3\text{H}_2\text{O}$ mixed with sulphates. The oxide $\text{Co}_3\text{O}_4 \cdot 3\text{H}_2\text{O}$ is obtained by warming cobaltous hydroxide with excess of potassium persulphate, and, after washing with water, heating the product at 100° with dilute nitric acid. The yield amounts to one-third of the cobaltous hydroxide.

The oxide $\text{Co}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$, obtained by treating cobaltous hydroxide with excess of potassium persulphate in the presence of excess of potassium hydroxide solution of sp. gr. 1.18—1.3, is a black precipitate which oxidises oxalic acid to carbon dioxide when heated with it, and is insoluble in cold, and only partially soluble in hot, concentrated nitric acid.

E. C. R.

Preparation of the Blue Oxide of Molybdenum and of Metallic Molybdenum. By ALLEN ROGERS and F. H. MITCHELL (*J. Amer. Chem. Soc.*, 1900, 22, 350—351).—The blue oxide of molybdenum is obtained by the addition of stannous chloride to a solution of ammonium molybdate slightly acidified with nitric acid. The precipitate is washed as quickly as possible, drained, and dried at 100° ; it seems to have the composition Mo_2O_3 , and is more readily reduced than the trioxide when heated in a current of hydrogen. Small quantities may be quickly reduced by placing the substance in a cavity in the lower of two carbon poles, and passing the electric current in an atmosphere of hydrogen; the resulting molybdenum is a very hard, dull steel-grey mass.

E. G.

Double Nitrates of Quadrivalent Cerium and of Thorium. By RICHARD JOS. MEYER and RICHARD JACOBY (*Ber.*, 1900, 33, 2135—2140).—Basic ceric nitrate, $\text{Ce}(\text{NO}_3)_3 \cdot \text{OH}$, has been obtained crystalline. Double nitrates of quadrivalent cerium and of thorium have been prepared (not all for the first time) of the types $\text{M}'_2\text{M}^{\text{IV}}(\text{NO}_3)_6$ and $\text{M}''\text{M}^{\text{IV}}(\text{NO}_3)_6 \cdot 8\text{H}_2\text{O}$, where $\text{M}^{\text{IV}} = \text{Ce}$ or Th , $\text{M}' = \text{NH}_4$, Rb or Cs , and $\text{M}'' = \text{Mg}$, Zn , Ni , Co , and Mn (and also Sr , when $\text{M}^{\text{IV}} = \text{Th}$). In addition, a salt, $\text{NH}_4\text{Th}(\text{NO}_3)_5 \cdot 5\text{H}_2\text{O}$, belonging to a different type, was prepared. Details are to be published later.

C. F. B.

[Purification of] Commercial Thorium Nitrate. By WILHELM MUTHMANN and E. BAUR (*Ber.*, 1900, 33, 2028—2031).—To purify thorium nitrate, 840 grams of the commercial product were dissolved in 5 litres of water, and into the solution was passed steam under 3 atmospheres pressure while 1 litre of 6 per cent. potassium chromate solution was added in drops. By repeating this operation six times, crystalline thorium chromate, $\text{Th}(\text{CrO}_4)_2 \cdot 3\text{H}_2\text{O}$, was obtained which yielded 320 grams of the white oxide, containing impurities to the extent of about 0.3 per cent. Mantles for incandescent burners prepared from this purified oxide give a light 1.3—1.4 times as intense as those prepared from the impure thorium salt. Impurities in the small proportion (1 per cent.) of ceria used in the mantles exert a far less deleterious action on the amount of light than those of the thoria, which constitutes the main bulk of the heated mixture.

T. H. P.

Gadolinium. By EUGÈNE DEMARÇAY (*Compt. rend.*, 1900, 131, 343—345).—The author has examined the spark spectrum of gadolinium magnesium nitrate containing only minute quantities of terbium, yttrium, and $\Sigma - \text{Z}$, and has determined the wave-lengths and relative intensities (maximum = 16) of 108 lines, which are given in the paper. The two most persistent are 3549.3 and 3545.7 with intensities of 10.5

and 10 respectively. Estimations of the atomic weight yield a number approximately the same as that obtained by previous observers, $Gd = 155$.
C. H. B.

Action of Sodium Thiosulphate on Potassium Antimony Tartrate. By FR. FAKTOR (*Chem. Centr.*, 1900, i, 1211; from *Pharm. Post*, 1900, 33, 233—234).—When a cold solution of potassium antimonyl tartrate is added to a cold solution of sodium thiosulphate and the mixture boiled, a compound, $SbSO_2$, separates as a bright red precipitate which may be washed with water, alcohol, and carbon disulphide, and dried at 100° ; the yield amounts to 5 per cent. of the tartrate used. When suspended in water, this compound is not attacked by hydrogen sulphide even at 80° , but when exposed to sunlight it shrinks in volume, becomes of a darker colour, and then has the composition Sb_2SO_4 . A brown precipitate, Sb_2SO_5 , is also obtained by mixing boiling solutions of potassium antimonyl tartrate and sodium thiosulphate.
E. W. W.

Mineralogical Chemistry.

Possibility of the Transference of Metals in Igneous Rocks through the Agency of Carbon Monoxide. By CLEMENS WINKLER (*Chem. Centr.*, 1900, i, 1307; from *Ber. k. sächs. Ges., Math.-phys. Kl.*, 1900, 52, 9—16).—It is suggested that the native iron found in the basalt of Disko Island, W. Greenland, may have been formed from iron and nickel carbonyls.
L. J. S.

Statement of Rock Analyses. By HENRY S. WASHINGTON (*Amer. J. Sci.*, 1900, [iv], 10, 59—63).—In order to introduce uniformity in the statement of rock analyses, so that the chemical character of a rock may be seen at a glance, it is suggested that the constituents be given in the following order, commencing with the eight principal oxides in the main portion of the analysis: SiO_2 , Al_2O_3 , Fe_2O_3 , FeO , MgO , CaO , Na_2O , K_2O , H_2O (ignition), H_2O (110°), CO_2 , TiO_2 , ZrO_2 , P_2O_5 , SO_3 , Cl , F , S (FeS_2), Cr_2O_3 , NiO , CoO , MnO , BaO , SrO , Li_2O .
L. J. S.

Calorimetric Examination of Pyrites and Marcasite. By ALFRED CAVAZZI (*Zeit. Kryst. Min.*, 1900, 32, 515; from *Rend. R. Accad. Sci. Ist. Bologna*, 1898, N.S. 2, 205—209).—The heat of combustion of pyrites and of marcasite is 1550 small calories for each mineral. Analyses of the material used gave:

	S.	Fe.	Si.	Total
Pyrites	47.53	52.09	0.30	99.92
Marcasite	47.56	52.17	0.22	99.95

L. J. S.

Sulpharsenites of Lead from the Binnenthal. By RICHARD H. SOLLY, with Analyses by HENRY JACKSON (*Min. Mag.*, 1900, 12, 282—297).—An historical account is given of the minerals sartorite, rathite, dufrenoyite, and jordanite which occur in the white saccharoidal dolomite of the Binnenthal in Switzerland, and a detailed crystallographic account is given of jordanite. The following new analyses, made only on crystals, lead to the formulæ: sartorite, $\text{PbS}_2\text{As}_2\text{S}_3$ (compare Abstr., 1896, ii, 109); rathite, $3\text{PbS}_2\text{As}_2\text{S}_3$ (compare Abstr., 1896, ii, 659); jordanite, $4\text{PbS}_2\text{As}_2\text{S}_3$. A collection is given of all the previously published analyses of these minerals; several, which were made on massive material, are placed under rathite, since they approximate to the new formula, $3\text{PbS}_2\text{As}_2\text{S}_3$, given above.

	Pb.	S.	As.	Sb.	Fe.	Total.	Sp. gr.
Sartorite...	43.24	25.81	30.80	—	—	99.85	4.980
„ ...	43.93	25.60	30.46	—	—	99.99	—
„ ...	43.72	25.12	30.12	—	—	98.96	—
Rathite.....	51.51	23.41	24.62	—	—	99.54	5.412
„ ...	51.62	23.64	24.91	—	—	100.15	5.421
„ ...	52.43	24.12	21.96	0.43	0.33	99.27	—
Jordanite...	68.61	18.19	12.32	—	—	99.12	6.413
„ ...	68.83	18.42	12.46	—	—	99.71	—

L. J. S.

Carnotite and Associated Vanadiferous Minerals in Western Colorado. By WILLIAM F. HILLEBRAND and F. LESLIE RANSOME (*Amer. J. Sci.*, 1900, [iv], 10, 120—144).—Ores of uranium and vanadium occur as yellow and green impregnations in sandstone over a wide area in Western Colorado; one, of a bright yellow colour, has been described by O. Friedel and Cumenge under the name carnotite (Abstr., 1899, ii, 434), of which the composition was given as $2\text{U}_2\text{O}_3 \cdot \text{V}_2\text{O}_5 \cdot \text{K}_2\text{O} \cdot 3\text{H}_2\text{O}$. In the present paper, the mode of occurrence is described, and several very detailed analyses are given, which, however, show considerable variations and do not confirm the above formula. Under I is given the maximum and minimum amounts of the more important constituents in six recalculated analyses made on the portion of the carnotite ore which is readily soluble in cold dilute nitric acid. The important constituents of the less soluble portion, given under II, show this to be a vanadiferous silicate, possibly allied to roscoelite. Carnotite is therefore a mixture of minerals.

The green colouring and cementing matter of certain sandstones near Placerville resembles roscoelite in composition, but it has less vanadium and more aluminium; the more important constituents in the recalculated analysis are given under III. The colouring matter in other green sandstones in the same region was found to be due to chromium.

	SiO_2	UO_3	V_2O_5	V_2O_3	Al_2O_3	Fe_2O_3	CaO	BaO	MgO	K_2O	H_2O
I. {	—	58.75	19.85	—	—	—	2.10	0.83	0.16	4.33	5.08
	—	61.53	21.09	—	—	—	4.70	3.64	0.31	8.39	10.54
II.	43.94	—	—	6.54	16.58	5.98	0.24	—	4.43	8.70	18.44
III.	46.06	—	—	12.84	22.55	0.73	0.44	1.35	0.92	8.84	6.05

L. J. S.

Vanadinite (Endlichite) from Hillsboro', New Mexico. By VICTOR GOLDSCHMIDT (*Zeit. Kryst. Min.*, 1900, 32, 561—578).—A detailed crystallographic description is given of the sulphur-yellow crystals of "endlichite" from Hillsboro', New Mexico. They have the same degree of symmetry (hexagonal with pyramidal hemihedrism), and very nearly the same axial ratio [$a:c=1:0.7126$] as ordinary vanadinite. Analyses by P. Jannasch of the tabular and of the columnar crystals gave the results under I and II respectively, agreeing with those required for the vanadinite formula $3\text{Pb}_3\text{V}_2\text{O}_8 + \text{PbCl}_2$. In I, the ratio $\text{V}_2\text{O}_5:\text{As}_2\text{O}_5$ is 8.6:1, and in II it is 11.7:1.

	PbO.	V ₂ O ₅ .	As ₂ O ₅ .	P ₂ O ₅ .	PbCl ₂ .	Total.	Sp. gr.
I.	69.30	17.66	2.60	0.35	9.98	99.89	6.88
II.	68.61	18.94	2.03	trace	9.73	99.31	6.88

L. J. S.

Perowskite from S. Ambrogio in the Valley of the Susa. By GIOVANNI BOERIS (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 52—55).—A description is given of perowskite crystals found in the zone of contact between the granite and the serpentine of S. Ambrogio. Analysis gave TiO_2 , 58.63; FeO , 0.86; CaO , 40.29, total, 99.78; formula, CaTiO_3 ; hardness between 5 and 6; sp. gr., 3.98. The colour varied from a honey-yellow through yellowish-brown to almost black. The mineral is accompanied by chlorite, apatite, magnetite, and ilmenite.

T. H. P.

Larderellite from the Suffioni of Tuscany. By GIOVANNI D'ACHIARDI (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 342—345).—Analysis of larderellite gives the following mean numbers: B_2O_3 , 72.06; $(\text{NH}_4)_2\text{O}$, 9.83; H_2O , 18.11 per cent. This indicates the formula $(\text{NH}_4)_2\text{B}_{10}\text{O}_{16} \cdot 5\text{H}_2\text{O}$, differing only in the water of crystallisation from the octahydrated ammonium pentaborate described by Rammelsberg in 1855. The specimen examined by Bechi, to which the formula $(\text{NH}_4)_2\text{B}_8\text{O}_{12} \cdot 4\text{H}_2\text{O}$ was given, probably contained impurities.

T. H. P.

Plumbogummite and Hitchcockite. By ERNALD GEORGE JUSTINIAN HARTLEY (*Min. Mag.*, 1900, 12, 223—233).—There is a want of agreement in the old analyses of the poorly crystallised lead aluminium phosphates, plumbogummite and hitchcockite; the following new analyses have therefore been made on carefully selected material. The pale lavender to bright smalt-blue material, formerly considered to be calamine, which encrusts quartz and pyromorphite from the old Roughten Gill lead mines near Caldbeck, Cumberland, gave analysis I; traces of copper and arsenic are also present; no water is lost at 100° . This agrees in composition with the white hitchcockite from Canton mine, Georgia, of which a new analysis is given under II. The formula for both is given as $5\text{PbO}, 9\text{Al}_2\text{O}_3, 4\text{P}_2\text{O}_5, 2\text{CO}_2, 24\text{H}_2\text{O} =$



Dark brown plumbogummite from Huelgoat, Brittany, gave the results under III and IV; about 1 per cent. of organic matter is present.

Deducting the amount of pyromorphite corresponding with the chlorine, and also lead sulphate and about 5 per cent. of water lost at 100°, the remainder agrees approximately with the formula given above. Associated with the dark mineral from Huelgoat is a lighter coloured crystalline material (anal. V) with some minute crystals having the form of pyromorphite; this is mainly pyromorphite with some lead aluminium phosphate.

	PbO.	Al ₂ O ₃ .	P ₂ O ₅ .	CO ₂ .	H ₂ O.	Cl.	Insol.	Total.
I.	37.03	28.74	18.64	3.12	12.73	—	—	100.26
II.	34.36	29.48	17.58	2.77	14.71	—	0.82	99.72
III.	43.24	19.04	18.37	4.59	14.50	0.29	—	100.03
IV.	38.91	20.98	19.14	4.66	15.44	0.16	SO ₃ 0.96	100.25
V.	75.93	2.78	16.81	0.44	1.96	2.32	—	100.24

Hitchcockite (from Georgia and Cumberland) therefore appears to be a definite mineral, and plumbogummite (from Huelgoat) to be a mixture of hitchcockite and pyromorphite.

L. J. S.

Beudantite. By ERNALD GEORGE JUSTINIAN HARTLEY (*Min. Mag.*, 1900, 12, 234—238).—The old analyses of beudantite differ so much that it is impossible to deduce any simple formula from them. The following new analysis was made on pure, dark green crystals supposed to be from the Glandore iron mines, Co. Cork (but possibly from Dernbach, Nassau). The material is soluble in strong hydrochloric acid. The formula is given as $3\text{PbO}, 4\text{Fe}_2\text{O}_3, \text{P}_2\text{O}_5, 3\text{SO}_3, 9\text{H}_2\text{O} = 3\text{PbSO}_4, 2\text{FePO}_4, 6\text{Fe}(\text{OH})_3$. Details of the method of analysis are given, and previous analyses are discussed.

PbO.	CuO.	Fe ₂ O ₃ .	P ₂ O ₅ .	As ₂ O ₃ .	SO ₃ .	H ₂ O.	Insol.	Total.
32.33	1.35	34.61	9.53	trace	12.72	8.45	0.56	99.37

L. J. S.

Florencite, a New Mineral from Brazil. By EUGEN HUSSAK and GEORGE T. PRIOR (*Min. Mag.*, 1900, 12, 244—248).—This new mineral has been found at three localities in Minas Geraes, namely, in the cinnabar-bearing sands of Tripuhy, in mica-schist near Tripuhy, and in diamond-bearing sands near Diamantina. The pale yellow crystals have a greasy to resinous lustre; they are rhombohedral [$\alpha : c = 1 : 1.1901$] with a fairly perfect basal cleavage. $H = 5$; sp. gr. 3.586; optically uniaxial and positive. Analysis gave:

Al ₂ O ₃ .	Ce earths.	Fe ₂ O ₃ .	CaO.	SiO ₂ .	P ₂ O ₅ .	H ₂ O.	F.	Total.
32.28	28.00	0.76	1.31	0.48	25.61	10.87	undet.	99.31

Water is only given off at a high temperature. The molecular weight of the cerium earths is 352, which is considerably higher than usually accepted; didymium appears to be present in only small amount. The formula is given as $3\text{Al}_2\text{O}_3, \text{Ce}_2\text{O}_3, 2\text{P}_2\text{O}_5, 6\text{H}_2\text{O} = \text{AlPO}_4, \text{CePO}_4, \text{Al}_2(\text{OH})_6$.

Florencite is related crystallographically and chemically to hamlinite, $3\text{Al}_2\text{O}_3, 2(\text{Sr}, \text{Ba})\text{O}, 2\text{P}_2\text{O}_5, 7\text{H}_2\text{O}$ (Abstr., 1898, ii, 123), and the two minerals are isomorphous, the strontium and barium of hamlinite

being replaced in florencite by cerium earths. These results support the conclusions of Wyruboff and others (Abstr., 1897, ii, 176) as to the isomorphism of many cerium salts with the corresponding salts of calcium and strontium, and the possible dyad character of the cerium earths.

L. J. S.

The Hamlinite-Florencite Group of Minerals. By GEORGE T. PRIOR (*Min. Mag.*, 1900, 12, 249—254).—It is pointed out that, owing to the difficulty of obtaining pure material and to imperfect methods of analysis and separation, mineral analyses are not so trustworthy as they are sometimes supposed to be when complex formulæ are deduced, and that when group relations can be made out, a more simple formula is sometimes preferable. On these grounds, it is suggested that hamlinite, florencite (preceding abstract), hitchcockite (this vol., ii, 600), beudantite (this vol., ii, 601), and svanbergite belong to the same isomorphous group of rhombohedral minerals, with the following formulæ and crystallographic constants:

	$a : c.$
Hamlinite, $2\text{SrO}, 3\text{Al}_2\text{O}_3, 2\text{P}_2\text{O}_5, 7\text{H}_2\text{O}$	1.1353
Svanbergite, $2\text{SrO}, 3\text{Al}_2\text{O}_3, \text{P}_2\text{O}_5, 2\text{SO}_3, 6\text{H}_2\text{O}$	1.2063
Hitchcockite, $2\text{PbO}, 3\text{Al}_2\text{O}_3, 2\text{P}_2\text{O}_5, 7\text{H}_2\text{O}$	—
Beudantite, $2\text{PbO}, 3\text{Fe}_2\text{O}_3, \text{P}_2\text{O}_5, 2\text{SO}_3, 6\text{H}_2\text{O}$	1.1842
Florencite, $\text{Ce}_2\text{O}_3, 3\text{Al}_2\text{O}_3, 2\text{P}_2\text{O}_5, 6\text{H}_2\text{O}$	1.1901

Here the group 2SO_3 is considered to be capable of replacing P_2O_5 without affecting the crystalline form; or writing hamlinite in the form $\text{SrHPO}_4, \text{AlPO}_4, \text{Al}_2(\text{OH})_6$, that is, as an ortho- instead of a pyrophosphate, the grouping SrHPO_4 may be considered as replaced in beudantite by PbSO_4 , in svanbergite by SrSO_4 , and in florencite by CePO_4 .

A new examination of svanbergite proves that the alkaline earth is mainly strontium and not calcium, as given in Blomstrand's analysis.

L. J. S.

Interpretation of Mineral Analyses: Constitution of Tourmaline. By SAMUEL L. PENFIELD (*Amer. J. Sci.*, 1900, [iv], 10, 19—32. Compare Abstr., 1899, ii, 304).—A reply to the criticisms of Clarke and Tschermak (Abstr., 1899, ii, 767; this vol., ii, 217). General remarks are made on the difficulties encountered in the analysis of minerals. Instead of deducing complex formulæ to suit particular analyses, it is better to assume the presence of some impurity.

L. J. S.

Asbestos [and Chrysotile]. By E. VAN DER BELLEN (*Chem. Zeit.*, 1900, 24, 392—393).—Light blue asbestos, in fibres 5—10 cm. long, gave on analysis the results under I, melting point 1150° ; hydrochloric acid (sp. gr. 1.124) dissolves 5 per cent. without destroying the silky lustre of the material. Greenish-brown "asbestos" [chrysotile], in fibres averaging 1 cm. long, gave II, agreeing with the serpentine formula $3\text{MgO}, 2\text{SiO}_2, 2\text{H}_2\text{O}$; melting point $1550\text{—}1570^\circ$; hydrochloric acid dissolves 57 per cent., leaving a residue consisting only of silica.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	K ₂ O(Na ₂ O)	H ₂ O	SO ₂
I.	56.79	3.85	8.03	—	1.00	20.48	5.93	3.73	0.59
II.	42.09	—	—	1.72	0.29	42.16	0.32	13.59	—

L. J. S.

Lasur-Oligoclase from Lake Baikal. By PAVEL V. VON JEREMIEFF (*Zeit. Kryst. Min.*, 1900, 32, 493—496).—These crystallographic notes on lasur-oligoclase, albite, and sphene from the neighbourhood of Lake Baikal were published in Russian in 1873, and are now for the first time given in German. The first-mentioned mineral was described by Nordenskiöld in 1857 under the name "Lasur-Felspath" as a variety of orthoclase, but the present author finds that the crystallographic elements agree closely with those of oligoclase, and he proposes the name "Lasur-oligoklas." The crystals are colourless to white with blue spots; some are decomposed and contain enclosures of calcite. Sp. gr. 2.587—2.598. Analysis gave:

SiO ₂	Al ₂ O ₃	CaO	MgO	Na ₂ O	K ₂ O	H ₂ O	CO ₂	Total
52.80	22.90	4.67	3.82	7.75	trace	3.66	3.90	99.50

L. J. S.

Sanidine from Monte Cimino, Rome. By FERRUCCIO ZAMBONINI (*Zeit. Kryst. Min.*, 1900, 32, 533—534; from *Rivista Min. Crist. Ital.*, 1898, 20, 20—64).—A description is given of crystals of Sanidine from Monte Cimino, near Viterbo. Regular intergrowths of sanidine with black mica or with augite occur. Analysis gave:

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	K ₂ O	Na ₂ O	CaO	MgO	TiO ₂	Total
65.20	18.51	0.41	11.37	3.40	0.65	1.23	0.12	100.89

The TiO₂, MgO, and Fe₂O₃ are probably due to enclosures of sphene and mica.

L. J. S.

Stokesite, a New Mineral from Cornwall. By ARTHUR HUTCHINSON (*Min. Mag.*, 1900, 12, 274—281).—A preliminary account of this new mineral has already been published (this vol., ii, 89); a more complete description is now given. The locality at which the only crystal known was found is Roscommon Cliff, St. Just. From the results of two analyses made on small amounts of material, the composition is given as follows:

SiO ₂	SnO ₂	CaO	H ₂ O	Total
43.1	33.3	13.45	8.6	98.45

At 220° there is a loss of 1.9 per cent., at 350° of 6 per cent., and the rest of the water is given off between 350° and dull redness. The formula H₄CaSnSi₂O₁₁ may be written in a variety of ways, as is the formula of catapleite, H₄Na₂ZrSi₂O₁₁, in different text-books.

Stokesite is the first example of a well crystallised definite compound containing silica and stannic oxide as essential constituents.

L. J. S.

[**Hornblende and Anorthoclase.**] By E. C. E. LORD (*Zeit. Kryst. Min.*, 1900, 32, 602; from *Amer. Geologist*, 1898, 22, 335—346).—In a paper descriptive of the dykes in the vicinity of

Portland, Maine, the following mineral analyses are given. I, a hornblende (sp. gr. 3.47) resembling barkevikite from a camptonite dyke; II, anorthoclase from the same rock.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	CaO	MgO	Na ₂ O	K ₂ O	H ₂ O	Total
I.	37.80	4.54	12.89	6.14	12.55	13.64	4.10	5.26	3.24	—	100.16
II.	57.34	—	20.79	2.88	—	4.27	0.16	8.09	4.17	2.66	100.36

L. J. S.

Prehnite in Metamorphosed Limestone. By ALFRED LACROIX (*Compt. rend.*, 1900, 131, 69—72).—Prehnite (variety coupholite) is recorded as being associated with zoisite, grossular, and orthoclase in metamorphosed limestone in contact with granite, near Barèges, Haute-Pyrénées.

L. J. S.

Physiological Chemistry.

Elimination of Carbon Dioxide during Respiration. I. Influence of the Concentration of the Blood on the Tension of the Carbon Dioxide in it. By VALENTINO GRANDIS (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 130—137).—According to some observers, notably Pflüger, the phenomenon of gaseous exchange in the lungs obeys the laws of diffusion of gases, whilst others, among whom is C. Ludwig, hold that diffusion phenomena are incapable of explaining all the circumstances observed in the mutual relations of the gas in the lungs and ascribe to the epithelium of the pulmonary vesicles the power of secreting carbon dioxide and of absorbing oxygen. On bringing venous or arterial blood into contact with concentrated sugar or salt solutions in an apparatus designed to allow of the pressure being accurately measured by means of a water manometer, the author finds that, corresponding with the increase of the concentration of the blood, there occurs an increase in the pressure of the gas contained in the apparatus. It is hence concluded that, in the living animal, the concentration brought about in the blood circulating in the lungs by water being given up to the air in the lung passages causes a temporary increase in the pressure of the gas in the blood, with the result that a quantity of carbon dioxide is evolved greater than that corresponding with the pressure of this gas in the blood before concentration.

T. H. P.

Elimination of Carbon Dioxide during Respiration. II. Influence of the Hygrometric State on the Passage of Carbon Dioxide from the Blood to the Air. By VALENTINO GRANDIS (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 224—230. Compare preceding abstract).—A series of experiments, made on venous blood taken from the jugular vein of a dog, show that dry air is capable of withdrawing from blood a quantity of carbon dioxide greater than is the case with

air saturated with water vapour. Confirmation is thus lent to the conclusion (*loc. cit.*) that the concentration of the blood, when circulating in the lungs, causes an increase in the pressure of the contained gas. The experiments also show that one of the causes of the injurious effects of a moist climate on health is that the moisture of the air prevents the free escape of the gaseous products of metabolism from the blood.

T. H. P.

Temperature of the Body during Fasting and the Speed of Assimilation of Carbohydrates. By UGO LINO MOSO (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 77—84).—The temperature of a fasting dog shows after some days a gradual decline. Doses of 1—4 grams of sugar per kilogram of body weight cause the temperature of a fasting dog to rise rapidly in the first 10 or 15 minutes, the maximum being, however, reached in from 1 to 2 hours. The increase of temperature is maintained for a period of time directly proportional to the quantity of sugar administered. Sugar brings about the recovery of dogs in a critical state of hypothermia where the use of albumin is without effect.

Comparison of the effects of bread and sugar on the temperature of a fasting dog show that when the fast is of short duration and the temperature only slightly below the normal, the change is more rapid with bread than with sugar, the digestion still maintaining its activity. In the case of prolonged abstention from food, sugar causes the quicker rise of temperature. The quantities of bread and sugar required to produce a given heating effect are in the ratio 2 : 1.

T. H. P.

Rate of Absorption and of Assimilation of Proteids and Fats. By UGO LINO MOSO (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 122—129. Compare preceding abstract).—The effects caused by proteids and fats on the temperature of fasting dogs have been examined. The results show that veal and the constituents of yolk of egg are utilised only slowly in the production of heat, indicating that albumin and fat are mostly used in the formation of the tissues. Albumin does not serve as a means of keeping emaciated dogs alive, but this can be accomplished by administering sugar. Butter and pig's fat, like albumin, have no effect on the temperature of a well-fed dog when given in small quantities.

T. H. P.

Absorption of Fat. By LUDWIG HOFBAUER (*Pflüger's Archiv*, 1900, 81, 263—266).—A contribution towards the elucidation of the problem as to whether unsaponified fat can be absorbed. If all the fat of the food is absorbed in a form which is soluble in water, the fat globules in the epithelial cells and in the chyle should be colourless, if the fat has been previously coloured with pigments which are insoluble in water. If the fat particles remain coloured, then the fat globules of the emulsion must have been absorbed as such. The pigments used were alkana-red, and "Lackroth A," and in dogs it was found that the absorbed fat particles in cells and chyle were still red. They were never blue, although these pigments are turned blue by alkalis. A case of chyluria is referred to in which, after giving coloured fat, the fat particles in the urine were found to be coloured also.

W. D. H.

Pathological Fats. By ALONZO ENGLEBERT TAYLOR (*Pfûger's Archiv*, 1900, 81, 131—137).—Attention is directed to the results of others, who have failed to find an increase of fat in cases of phosphorus poisoning, and to the difference of opinion which exists in relation to the possibility of the formation of fat from proteid. In the present experiments, the liver fat in a case of acute yellow atrophy in man was found to contain 81 per cent. of olein and 3 per cent. of volatile fatty acids; the liver contained only traces of glycogen. In a series of cats, fatty infiltration of the kidney was produced by the use of sodium cantharidinate; the fat was compared with that of the healthy cat's kidney. The results are entirely negative as far as the question of the origin of the fats is concerned. The amount of fat from each pair of nephritic kidneys averaged 1.136 gram; from each pair of healthy kidneys, 1.640 gram. The most marked qualitative difference noted is an increase of olein in the pathological fat.

The following table gives the main results obtained; the normal fat was obtained from 12, the pathological from 9 pairs of kidneys.

	Normal fat.	Pathological fat.
Ether extract	19.686 gr.	11.230 gr.
Melting point of fatty acids	39.8°	34.7°
Acid number	6.8	12.9
Saponification number	218.8	178.8
Ether number	212	165.9
Reichert-Meissl number.....	5.7	3.6
Acetyl number	14.2	22.5
Olein per gram	0.3006 gr.	0.496 gr.
		W. D. H.

The Influence of "Saccharin" [*o*-Benzoisulphinide] on Digestion. By F. BERLIOZ (*Chem. Zeit.*, 1900, 24, 416—417).—The experiments on artificial gastric, and pancreatic digestion here recorded confirm those previously performed by Nencki (*Chem. Zeit. Repert.*, 1899, 23, 372), but are contrary to what has been stated by several previous experimenters. They show that "saccharin" does not hinder digestion.
W. D. H.

Phosphorus in Paranuclein from Casein. By HOLMES C. JACKSON (*Amer. J. Physiol.*, 1900, 4, 170—177).—The paranuclein, obtained by artificial gastric digestion from casein, contains phosphorus in organic combination. Chittenden's results in which the phosphorus recovered in the ash was equivalent to the total phosphorus of the paranuclein, are attributed to the large amount of ash in the products employed. If this is avoided and the formation of inorganic phosphates during ignition precluded, paranuclein yields over 2 per cent. of phosphorus.
W. D. H.

Influence of Experimental Modifications on the Consumption of Sugar. By ALBERT CHARRIN and A. GUILLEMONAT (*Compt. rend.*, 1900, 131, 126—128).—It has been previously shown in rabbits that the injection subcutaneously of a saline mixture increases their metabolic activity, whilst injection of various acids does the reverse. It

is now shown that if dextrose is injected as well, a certain quantity leaves the body by the urine, the remainder being utilised. The amount which is eliminated and the time during which the excretion lasts are increased greatly in the animals treated with acid.

W. D. H.

Behaviour of certain Artificial Hexoses in the Animal Body. By A. MÜNCH (*Zeit. physiol. Chem.*, 1900, 29, 493—516).—After the injection of formose into the jugular vein of rabbits, 71·5 per cent. appears unchanged in the urine. In well-fed rabbits, injection into the mesenteric vein causes glycosuria; the amount of glucose in the urine corresponds with that of formose injected. In starving rabbits, this does not occur, but about 11 per cent. of the formose appears unchanged in the urine. Formose serves to form glycogen, and thus may pass into the condition of dextrose. The digestive ferments have no action on it. Methose behaves qualitatively in the same way, but there are quantitative differences. The results with β -methylglucoside were also in the same direction.

W. D. H.

Uric Acid Formation after Splenectomy. By LAFAYETTE B. MENDEL and HOLMES C. JACKSON (*Amer. J. Physiol.*, 1900, 4, 163—169. Compare this vol., ii, 288).—Further experiments on dogs and cats are recorded, which show that the spleen has little or nothing to do with the production of uric acid. Experiments on the lymphatic glands are also negative.

W. D. H.

Results of the Extirpation of the Liver in Dogs. By SERGEI SALASKIN and J. ZALESKI (*Zeit. physiol. Chem.*, 1900, 29, 517—552).—The liver was removed in fourteen dogs; the urine was examined for nitrogen, urea, and ammonia. Full details of each experiment are given. Four animals died almost immediately; the majority between 5 and 6 hours later; one lived for 13 hours; the quantity of urine collected varied from 1·8 to 118·5 c.c. It had always an acid reaction; the percentage of urea sank, and that of ammonia rose, but these were not parallel. The blood and brain were also examined, but no rise of ammonia was found. There are thus differences between these results and those of Minkowski in geese. In dogs with an Eck's fistula, the toxic symptoms are due to accumulation of ammonia; in dogs with extirpated liver there is evidence of acid-poisoning.

W. D. H.

Proteolytic and Amylolytic Ferments in the Contents of the Human Colon. By JOHN C. HEMMETER (*Pflüger's Archiv*, 1900, 81, 151—166).—Extracts of human fæces, even in cases of atrophy of the stomach, have weak proteolytic, no lipolytic, and powerful amylolytic properties. The proteolytic ferment is not pepsin, as it will not act in an acid medium. The source of the ferments is probably the pancreas or the intestinal glands.

W. D. H.

Physico-chemical Relations of Animal Fluids and Tissues. By MAX OKER-BLOM (*Pflüger's Archiv*, 1900, 81, 167—221. Compare this vol., ii, 290, 356).—If potassium chloride, potassium sulphate, and

magnesium sulphate dissolved in serum are mixed with defibrinated ox-blood so that the osmotic pressure of the serum of the mixture is raised, they act on the blood corpuscles but little, whilst ammonium chloride and sulphate produce, under similar conditions, a marked effect. If aqueous solutions of potassium chloride or sulphate are mixed with the blood, they act on the corpuscles only when the osmotic pressure of their solutions is higher than that of the serum; they lose this property when the osmotic pressure of the serum is lowered. Magnesium sulphate in aqueous solution acts similarly. In the case of the ammonium salts, however, hypotonic as well as hypertonic solutions enter the corpuscles, but less forcibly. In all cases smaller quantities of the sulphates are necessary to produce the effects. These phenomena are related to that of electrical conductivity, which, although the method is but little used, forms a trustworthy guide to the power of electrolytes to penetrate the corpuscles. W. D. H.

Artificial Parthenogenesis. By JACQUES LOEB (*Amer. J. Physiol.*, 1900, 4, 178—184. Compare this vol., ii, 555).—Further experiments on this subject are stated to show that, by a certain increase in the osmotic pressure of the surrounding solution, the unfertilised eggs of some echinoderms can be caused to develop into normal blastulae or even plutei. This increase in osmotic pressure can be produced by electrolytes as well as by non-conductors. It is therefore probable that the parthenogenetic development is caused by the egg losing a certain amount of water. W. D. H.

Chemical Fertilisation of Eggs. By VIGNIER (*Compt. rend.*, 1900, 131, 118—121. Compare Loeb, this vol., ii, 555, and preceding abstract).—In a repetition of some of Loeb's experiments on the development of echinoid eggs, no grounds were found for believing his theory that any egg can develop parthenogenetically provided it is supplied with appropriate saline mixtures. In fact, magnesium chloride was found to hinder rather than favour development. Before accepting such sweeping ideas, it is necessary to show that the instances examined by Loeb were not accidental cases of true parthenogenesis. W. D. H.

Further Experiments on Tetanus Toxin and Antitoxin. By F. RANSOM (*Zeit. physiol. Chem.*, 1900, 29, 553—567. Compare this vol., ii, 558).—Antitoxic dog serum, like that of the horse, when injected into the blood-stream of dogs, divides itself between blood and lymph. Some time after the injection, there may be twice as much in the blood as in the lymph. The tetanus toxin, like the antitoxin, after being injected subcutaneously, passes into the blood *via* the lymph, but in the case of the toxin this takes place with great slowness. If the toxin is already in the blood and lymph, it is rapidly neutralised by injection of the antitoxin into the blood or lymph stream. W. D. H.

Composition of the Placenta: Its Solid and Liquid Components, Organic Compounds, Extractive Matter, and Albumoses. By VALENTINO GRANDIS (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 170—176).—The placenta was freed quickly from membrane and, after as much blood as possible had been removed, it was pounded into

a paste. On drying and igniting this paste, the mean numbers obtained were: dry substance, 16.09; water, 83.89; ash, 1.073 per cent. Extraction with water at 35° and removal of the albumin by coagulation gave the numbers: extractive matter, 1.925; dry albumin, 5.783; ash of albumin, 0.072. Further extraction under 2 atmospheres pressure removed 3.654 per cent., the insoluble residue amounting to 3.607 per cent. The water used for washing the placenta gave, on analysis: dry albumin, 1.37 and 2.16; ash, 0.017 and 0.064; whilst the red globules removed from the wash water gave: dry albumin, 1.58 and 2.39; ash, 0.017 and 0.024. These values, which vary very widely owing to the different amounts of blood retained, are calculated on the original weight of placenta. T. H. P.

Composition of the Ash of the Placenta. By VALENTINO GRANDIS (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 262—266. Compare preceding abstract).—Analysis of the ash of the placenta gives the following percentages: Cl, 11.4; S, 0.204; Na, 24.93; K, 6.57; PO₄, 33.46; CaO, 2.32. The ash of the albumin extracted by water from the placenta contains Na, 0.251 and PO₄, 55.18 per cent., whilst after previously washing the placenta with a 0.75 per cent. sodium chloride solution, the numbers are Na, 0.728, and PO₄, 44.5. The large proportion of phosphorus seems to indicate that the placenta fulfils a more important function than that of a mere mechanical organ of communication between the mother and the fœtus. It is noteworthy that the phosphorus is contained in substances which are extracted by water and are also precipitated together with the albumin from the aqueous solution. T. H. P.

Some Scientific and Ethical Questions of Biological Chemistry. By JOHN LEWIS W. THUDICHUM (*J. pr. Chem.*, 1900, [ii], 61, 568—575).—A controversial paper.

Chemistry of Vegetable Physiology and Agriculture.

Composition of Plankton. By K. BRANDT (*Bied. Centr.*, 1900, 29, 423; from *Naturw. Wochenschr.*, 1898, 13, 594).—Samples of plankton, and of its single constituents, obtained from Kiel Bay, were found to have the following composition:

	Proteids.	Fat.	Non-nitrog. extract.	Crude fibre.	Ash.
Plankton (autumn and winter) ...	20.2—21.8	2.1—3.2	60.0—68.9	8.5—15.7	
Peridinea	13.0	1.3	39.0	41.5	5.2
Diatoms	28.7	8.0	63.2	—	—

Samples of summer plankton consisted chiefly of animals and contained therefore a high percentage of proteids and not much carbohydrate; the amounts of fat varied considerably. N. H. J. M.

Influence of the Temperature of Liquid Air on Bacteria. By ALLAN MACFADYEN (*Proc. Roy. Soc.*, 1900, 66, 180—182, and with SYDNEY ROWLAND, 339—340).—In the first set of experiments, pure cultivations of ten organisms, including the very sensitive spirillum of *Cholera Asiatica* and the highly resistant spores of *Bacillus anthracis*, were exposed for 20 hours at the temperature of -182° to -190° . The bacteria lost none of their vital properties. The photogenic bacteria became non-luminous when cooled down, but their luminosity was restored as the temperature was allowed to rise. A sample of yeast cell plasma also was not altered by being subjected for 20 hours to the same temperature.

In the second series, broth emulsion cultures sealed in fine quill tubing were completely immersed in liquid air for 7 days. The vitality of the organisms was in no way impaired. N. H. J. M.

Influence of the Temperature of Liquid Hydrogen on Bacteria. By ALLAN MACFADYEN and SYDNEY ROWLAND (*Proc. Roy. Soc.*, 1900, 66, 488—489. Compare preceding abstract).—Exposure for 10 hours at a temperature of about -252° had no effect on the following organisms: *Bacillus acidi lacti*, *B. typhosus*, *B. diphtheria*, *Proteus vulgaris*, *B. anthracis*, *B. coli com.*, *Staphylococcus pyogenes aureus*, *Spirillum cholerae*, *B. phosphorescens*, *B. pyocyaneus*, a *Sarcina*, and a yeast. N. H. J. M.

Present Position of the Nitrugin Question. By JULIUS STOKLASA (*Zeit. landw. Versuchswes. Oesterr.*, 1898, 1, 78—88).—Pure cultures of *Bacillus radicola* promote the growth of leguminous plants, the amount of increase depending on the nature of the soil. The results of experiments in which lupin plants were deprived of their root-nodules, and afterwards grown in sterilised sand, indicated that fixation of nitrogen takes place, not in the nodules, but in the leaves. The bacteria seem to separate a kind of enzyme which causes the living protoplasm to assimilate elementary nitrogen. *B. radicola* does not fix free nitrogen, but some species of fluorescence bacilli, which assimilate free nitrogen, were obtained from soil. N. H. J. M.

Further Observations on Nitrugin, and the Nature and Functions of the Nodules of Leguminous Plants. By MARIA DAWSON (*Proc. Roy. Soc.*, 1900, 66, 63—65. Compare Abstr., 1899, ii, 785).—A study of the organisms from *Desmodium gyrans* showed they, as well as those from nitrugin and from pea nodules, grow readily on gelatin or agar containing an extract of pea straw, asparagine, and sugar, but very slowly on broth-gelatin. They do not peptonise milk. The organisms are aerobic, and may pass through a short motile stage.

Addition of nitrate to sterilised cultures of plants gave better results than inoculation, whilst the inoculation of plants manured with nitrate decreased the yield. N. H. J. M.

Fermentation without Cells. By FELIX B. AHRENS (*Zeit. angew. Chem.*, 1900, 483—486).—Yeast extract may be concentrated by cooling to a temperature not lower than -2° , stirring and expressing the liquor from the resulting magma of crystals. By repeating this pro-

cess several times, the sp. gr. of the liquor may be raised from 1.0378 at 12° to 1.0765 at 14°. This concentrated extract gave satisfactory results in experiments where the original extract was too dilute. The author considers that zymase is present as a colloidal substance, and not in a state of true solution; that its loss of activity is due to acidity, which always develops in a few hours, and that the fluorescence, which disappears when the extract is kept or used as a fermenting agent, is caused by the zymase itself. Samples of the extract, in its original form and after concentration, were fractionally precipitated, the dried products analysed, and their percentage composition calculated on an ash-free basis. The carbon shows the greatest variation, but no discussion of the tabulated results is attempted.

R. L. J.

Furfuroids of Plant Tissues. By CHARLES FREDERICK CROSS, EDWARD JOHN BEVAN, and J. S. REMINGTON (*J. Soc. Chem. Ind.*, 1900, 19, 307—310).—Direct experiment has proved that hydrolysed furfuroids are almost completely digested and assimilated by herbivorous animals such as the rabbit. Previous researches have shown that in “the permanent tissue”—the residue from the solvent action of alkaline (sodium hydroxide) and acid (hydrochloric acid) solutions in the cold—the ratio of furfuroids to other carbohydrates is greater than in the total plant. After ensilage, the opposite is true; for example, a permanent tissue gave a furfuraldehyde number of 6.1 per cent., whereas the total furfuraldehyde was 9.3 per cent. On the other hand, however, the furfuroids show an increased resistance to processes of acid hydrolysis after ensilage.

J. J. S.

Nature of the Reserve Carbohydrates in the St. Ignatius Bean and Nux Vomica. By ÉMILE BOURQUELOT and J. LAURENT (*Compt. rend.*, 1900, 131, 276—278. Compare this vol., ii, 498).—The albumen of the St. Ignatius bean was heated for an hour and a half at 110°, under pressure, with dilute sulphuric acid containing from 1—3 per cent. of acid. The total quantity of sugar formed increased with the concentration of the acid, whilst the ratio of mannose to galactose varied considerably, the proportion of galactose being higher the more dilute the acid. When the albumen of *nux vomica* is heated for varying periods of time with acid of constant strength (1:100), the proportion of galactose increases considerably with the duration of heating. These results indicate that the two sugars are not derived from a single mannogalactan, or from one mannan and one galactan, but from several mannans and galactans of different degrees of complexity, analogous to the dextrans in starch.

C. H. B.

Dissolution of the Nitrogenous Compounds in Malt. By PAUL PETIT and G. LABOURASSE (*Compt. rend.*, 1900, 131, 349—351).—Malt was treated with water for two hours at different temperatures, and one-half of each infusion was boiled for some time, cooled, and made up to its original volume. Estimations were made in both the boiled and unboiled portions of the total nitrogen, the nitrogen precipitated by phosphotungstic acid and sulphate of zinc respectively, and the nitrogen existing as ammonia after treatment with dilute hydrochloric

acid. The total soluble nitrogen gradually increased with the temperature, and reached a maximum at 55°, whilst the coagulable compounds gradually decreased, and the total nitrogen also began to decrease at and beyond 62°. The sum of the various quantities of nitrogen separately estimated in the manner indicated was considerably greater than the total nitrogen actually present. The results with the un-boiled infusions were somewhat irregular, probably owing to the action of enzymes, and the action of hydrochloric acid on the insoluble compounds. With the boiled portions, the results were more regular; the nitrogen precipitated by phosphotungstic acid and zinc sulphate increased up to 45° and then decreased, whilst the total soluble nitrogen increased up to 55°, and then gradually diminished. Arginine is formed under conditions which will be described subsequently.

C. H. B.

Formation and Decomposition of Albumen in the Plant. By ERNST SCHULZE (*Chem. Centr.*, 1900, i, 1031—1032; from *Ber. Deut. bot. Ges.*, 18, 36—42).—The fact that in young *Papilionaceæ* which contain large quantities of the decomposition products of albumin the increase of albumin is not accompanied by any decrease in the amount of asparagine present, is explained by supposing that the initial decomposition products of albumin are converted into glutamine and asparagine. In accordance with this theory, the young plants were found to contain more of the primary decomposition products of albumin than the older plants. Whilst asparagine is of use in the synthesis of albumin in the plant, the amino-acids have not proved to be good substitutes.

E. W. W.

Formation of Proteids in Plants. By ADOLF EMMERLING (*Landw. Versuchs-Stat.*, 1900, 54, 215—281. Compare Abstr., 1887, 615).—Further evidence is adduced in favour of the hypothesis that amino-acids in plants are produced from simple inorganic nitrogen compounds and organic matter already formed by assimilation. The process takes place mainly in the leaves. As time goes on and the amount of amino-acids is in excess of that required for leaf production, the acids are utilised in the development of seeds. The amount of amino-acids gradually decreases when the seeds ripen, not only in the seeds themselves, but in the leaves, &c.

Simultaneously with the production of amino-acids, other nitrogenous non-proteids are formed the nature of which is not known. These compounds are less prominent than the amino-acids in nearly all parts of the plant during the chief period of the synthetical formation of amino-acids and proteids. But as the seeds ripen, the "bases," as these compounds are provisionally termed, increase in quantity and finally predominate over the amino-acids both in the seeds and in the leaves, &c. It is probable that the "bases" are of physiological importance, but there is as yet no evidence to show in what manner.

N. H. J. M.

Conditions of the Production of Proteids Insoluble in Gastric Juice and their Importance for the Respiration of Plants. By WLADIMIR FALLADIN (*Bisd. Centr.*, 1900, 29, 478—481).—The proteids of the living substance of vegetable cells leave a nitro-

genous residue insoluble in gastric juice, whilst the "dead" proteids are dissolved.

Etiolated leaves of *Vicia faba* were kept for several days in 5 or 10 per cent. solutions of cane sugar, in darkness, in diffused daylight, and in yellow and blue light respectively. The amounts of dry matter, proteids, and indigestible proteids were determined as well as the amounts of carbon dioxide produced per hour.

The sugar was utilised much more readily in presence of light than in darkness, and the regeneration of proteids, which took place even in absence of light, was much more energetic in diffused light; blue light was more favourable than yellow. Undigestible proteids, which were present only in very small quantity in the etiolated leaves, were produced in the dark in presence of sugar, but the production was much greater under the influence of light.

The energy of respiration of leaves supplied with sugar was more than twice as great in presence of light than in darkness. It was greatest in white, and least in yellow light.

From the results of previous experiments (Abstr., 1898, ii, 248), it was concluded that the energy of respiration was directly proportional to the amount of "living proteid" at a given temperature and in presence of sufficient carbohydrate. It is now shown that there may be considerable variations.

N. H. J. M.

Germination of the Olive. By GIOVANNI SANI (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 47—51).—The constituents of olive seeds are as follows: Water, 9.82; fats, 42.00; reducing sugars after hydrolysis with 5 per cent. sulphuric acid, expressed in terms of glucose, 14.73; proteids (nitrogen \times 6.25), 17.02; ash, 2.87. After germinating for a week in the dark at 30°, the plantlets were dried at 110°, 10.63 per cent. of dry substance being obtained and analysed, the results being as follows: Fat, 6.23; reducing sugars present as such, in terms of dextrose, 4.60; further reducing sugars formed on hydrolysis, 26.34; pentosans, 9.51; nitrogen, 4.54. 1.3286 grams of the plants after treatment with water required 2 c.c. decinormal potassium hydroxide for neutralisation.

T. H. P.

Development and Injurious Effect of Mustard Oil from Rape-Cake. By B. SJOLLEMA (*Landw. Versuchs-Stat.*, 1900, 54, 311—318).—The introduction of an emulsion containing 0.2 gram of mustard oil into the stomach of a rabbit caused death. The same result was obtained by the simultaneous introduction of *Myronas Kalicus* (0.850 gram) and an extract of white mustard seed (6 grams). Both mustard seed and *Myronas Kalicus* were without effect when given alone. Mustard oil emulsion (0.2 gram), two days old, did not kill the rabbit, but otherwise produced the same symptoms. Another emulsion (0.3 gram), three weeks old, caused the death of the rabbit, but its action was slow.

The volatile oil, containing sulphur, which develops in rape seed by the action of an enzyme, is not identical with allylthiocarbimide and is much less poisonous. A rabbit which received 0.262 gram

of the oil showed no abnormal symptoms. The estimation of mustard oil in rape cake is, therefore, not to be depended on for ascertaining whether the cake is poisonous. The volatile oil obtained from rape boils at 173°, has an odour resembling that of mustard oil, but much less sharp, and floats on water. As regards the estimation of mustard oil, both the oxidation and Jørgensen's methods give somewhat low results.

Myrosin is rendered inactive by heating at 72°, but not at 65°. Neither pepsin alone nor pepsin and hydrochloric acid produce mustard oil from rape cake or *Myronas Kalicus*. Ptyalin acts with extreme slowness if at all. N. H. J. M.

Action of Calcium Hydroxide on Germination. By RICHARD WINDISCH (*Landw. Versuchs-Stat.*, 1900, 54, 283—309. Compare Sigmund, *Abstr.*, 1896, ii, 442).—Solutions, or emulsions, containing 0.066—3.9642 per cent. of calcium hydroxide had very little effect on the germination of barley, oats, and wheat; in the case of rye, the number of seeds which germinated was somewhat reduced by the weakest solution. In a second series of experiments, the effect of solutions or emulsions containing 0.1724 to 5 per cent. of calcium hydroxide on the germination of a variety of seeds was observed. The results showed that the solutions affect chiefly the energy of germination, but that the extent of the action has no relation to the concentration of the solutions. The more dilute solutions have relatively more effect than the more concentrated ones. Only the dissolved hydroxide can penetrate into the cells; on the other hand, the undissolved lime seems to have some mechanical action, since seeds sometimes failed to germinate in emulsions when a saturated solution had no effect. Ordinary lime water, diluted with 2—3 parts of distilled water, was in some cases beneficial, and in others injurious. Wheat was not injured by the greatest amount of lime; oats germinated better in presence of lime than in distilled water; the germination of maize was somewhat delayed by concentrated solutions, whilst oats were injured.

Cruciferous seeds were injured by dilute lime water, and leguminous seeds, which are the most sensitive in this respect, were killed by comparatively dilute solutions. N. H. J. M.

Finnish Moss-Berry (*Vaccinium oxycoccus*). By F. STOLLE (*Zeit. Ver. Deut. Zuck.-Ind.*, 1900, 609—610).—The moss-berry of Finland, which is an extremely valuable food-stuff, yields, on crushing, about 74 per cent. of its weight of juice having a sp. gr. 1.0373. After the addition of ammoniacal lead acetate and concentration of the filtrate, invert sugar separates out. From the lead precipitate glyoxylic acid has been isolated. T. H. P.

Composition of Fodders. By ADOLF EMMERLING (*Bied. Centr.*, 1900, 29, 454—457; from *Jahresber. agrik.-chem. Versuchs-Stat. Kiel*, 1898, 15).—The results of fifty complete analyses of fodders (residues from oil factories and distilleries, molasses, meadow and clover hay, and straw, &c.) are given in tables. Also the results of determinations of proteid, fat, and acidity in a number of oil-cakes. N. H. J. M.

Changes in Expressed Olives when Stored under Different Conditions. By OTTO KLEIN (*Zeit. angew. Chem.*, 1900, 635—637).—Analyses were made of compressed olives kept under the following conditions: (1), air dried; (2), compressed in a covered glass vessel; (3), not compressed, and moistened with the expressed fruit-water; and (4), compressed and moistened with the fruit-water.

The results showed that in practice it is best to dry the residues as quickly as possible, or else to compress them with, or without, addition of the fruit-water. The loss of fat then is only slight.

Expressed olives are not of much value either as food or as manure, and to increase their value it is of importance to return the fruit-water, which contains much of the proteids and ash constituents. In this way a product is obtained the composition of which more nearly approaches that of olives.

Analyses of olives, expressed olives, and of the fruit-water are given.

N. H. J. M.

Experiments on Feeding Cows with Mixed Grain and Maize. By F. FRIIS (*Bied. Centr.*, 1900, 29, 461—464; from *45-de Beretn. kgl. Vet. Landbohøjsk. Lab. landøk. Forsøg. Copenhagen*, 1899, 1—75).—The experiments were made at several farms with a large number of similar cows. Each group received cake, roots, hay, and straw, and in addition (A) mixed grain, (B) half mixed grain and half maize, and (C) maize.

Feeding with maize had no appreciable effect on the composition of the milk, but slightly increased the yield; there was also a slight increase in live weight. The butter from the cows fed with maize was of slightly better quality than when mixed grain was employed.

As regards the composition of the two foods the most important difference was in the amount of starch; the mixed grain contained 42.69, and the maize 56.74 per cent.

N. H. J. M.

Composition of the Alluvial Soil of Lodi. By FASCETTI and GHIGI (*Bied. Centr.*, 1900, 29, 421; from *Staz. sper. agrar. ital.*, 1899, 32, 131).—Analyses of the soil at different depths (0.5 m. to 3.1 m.) showed that it contained very little organic matter and nitrogen (N=0.079 to 0.019 per cent.), whilst the phosphoric acid, soluble in boiling hydrochloric acid, diminished from 0.194 at a depth of 0.5 m. to 0.125 per cent. in the lowest sample. The upper layers of the soil contained 0.61—0.70 per cent. of lime, and the lower layers 2.01 to 4.25 per cent. The amounts of potash dissolved by hydrochloric acid were 0.43—0.58 per cent. in the more sandy layers, whilst the layers with 10 or 11 per cent. of clay contained 0.70—0.84 per cent. of potash.

N. H. J. M.

Vegetation Experiments with Various Peat Soils. By HEINRICH IMMENDORFF and BRUNO TACKE (*Bied. Centr.*, 1900, 29, 443—446; from *Landw. Jahrb.*, 1898, 27, *Erg.-bd. IV.* 259—302).—The results of pot experiments with peat soil containing 2.52—3.39 per cent. of nitrogen showed that nitrogen manures were effective with oats, barley, and sugar-beet. The effect of nitrogenous manures is least in soils in which nitrification is most active, and this probably

depends to a great extent on the porosity of the soil, and the amount of water present. In the case of lighter soils, an excess of water is comparatively harmless, whilst dense soils are greatly injured. Light soils require, therefore, less drainage than dense soils.

The greatest yields of barley and oats were obtained when the soil was not quite saturated with water, but the greatest yield of nitrogen was observed under conditions of medium moisture. With oleaginous radish, the maximum yield was obtained under the same conditions; the maximum yield of nitrogen when the soil contained the greatest percentage of water. This is partly due to the greater evaporation from radishes.

Subsoil liming increased the yield of potatoes and oats by 16 and 18 per cent. respectively, whilst the yield of barley in field experiments was increased 70 per cent. (compare this vol., ii, 42). N. H. J. M.

Action of Animal Manure on Peat Soil. By PAUL HELLSTRÖM (*Bied. Centr.*, 1900, 29, 449—450; from *Tidskr. landtm.*, 1899, 20, 697—705).—Owing to the difficulties of obtaining lime and artificial manures in some parts of the north of Sweden, experiments were made to ascertain whether new peat land can be decomposed and thus rendered fertile by means of bacteria introduced along with farmyard manure, instead of by lime.

Peas were grown in zinc vessels and watered with extracts of horse-, sheep-, and cow-dung respectively. In each case, one pot had fresh and another sterilised extract. There were also two pots which had slaked lime, and two with soil alone.

All the extracts and the lime increased the yield of corn and straw; the fresh horse- and sheep-dung extracts were very much more effective than the same extracts sterilised. In the case of cow-dung extract, sterilisation had very little depressing effect. The results show, therefore, that horse- and sheep-dung are the best for peat land, not only as manures, but on account of the bacteria they contain. N. H. J. M.

Action of Burnt Lime and Marl on Sandy Soil. By BRUNO TACKÉ, HEINRICH IMMENDORFF, A. SALFELD, and FR. WOLFF (*Bied. Centr.*, 1900, 29, 448—449; from *Landw. Jahrb.*, 1898, *Erg.-bd. IV.*, 431).—When applied to the soil in the usual quantity, burnt lime does not injure the leguminous bacteria, but it acts with much greater vigour than marl on the nitrogenous constituents of the soil. In the case of poor sandy soil, marl is preferable to burnt lime.

The results of previous experiments in which lime seemed to act injuriously on the growth of the leguminous crop, whilst marl was not injurious, are now attributed partly to loss of soil nitrogen under the influence of lime, and partly to ineffective inoculation. The inoculation on the marled land was probably due to bacteria having been introduced along with the marl. N. H. J. M.

Top Dressing Experiments with Ammonium Sulphate and Sodium Nitrate. By KLÖPPER (*Bied. Centr.*, 1900, 29, 371—373; from Fühling's *Landw. Zeit.*, 1899, 114 and 138. Compare Abstr., 1899, ii, 512).—A reply to Wagner (Abstr., 1899, ii, 572) and Maercker (*Deut. landw. Presse*, 1898, No. 25 and 26).

The results of experiments with winter wheat, grown on heavy loam and on light sandy soils, in which the same amount of nitrogen was applied in the form of ammonium sulphate and as sodium nitrate, showed in each case a greater production of grain and straw under the influence of ammonium sulphate. The heavy soil contained 0.31 per cent. of lime and had previously been manured with dung, kainite and basic slag. The sandy soils contained 0.05 and 0.045 per cent. of lime.

In similar experiments with winter rye on loamy sand containing 0.62 per cent. of lime, sodium nitrate produced 17.5 kilos. more grain per hectare than ammonium sulphate, but 249 kilos. less straw. A second experiment with winter rye on soil containing 1.02 per cent. of lime showed that ammonium sulphate produced greater yields both of grain and straw (138 and 537 kilos.) than sodium nitrate.

Ammonium sulphate produced on the whole more grain than sodium nitrate, and the quality of the grain was better. N. H. J. M.

Sugar as an Aid to the Growth of Plants. By JOHN GOLDING (*J. Soc. Chem. Ind.*, 1900, 19, 324—325. Compare Abstr., 1899, ii, 689).—The results of sand-culture experiments with beans and lucerne showed that addition of sugar considerably increased the growth when the plants were inoculated. Sugar produced the same result with beans and sainfoin when the plants were manured with ammonium nitrate instead of being inoculated. Similar results were obtained in soil.

In absence of ammonium nitrate, or without inoculation, addition of sugar decreased the amount of produce, especially in the case of sainfoin and beans grown in sand.

Comparing the total yields of the different plants under the influence of inoculation and of combined nitrogen respectively, the results show in some cases inoculation, and in others nitrogenous manure to be the more effective.

Excess of sugar may kill the plants.

N. H. J. M.

Cultivation of Mulberry Trees. By V. ALPE (*Bied. Centr.*, 1900, 29, 422—423; from *Agric. Mod.*, 1899, 5, 121).—In the Italian method of cultivating mulberry trees the average quantity of wood and leaves removed yearly amounts to 20 and 25 kilos. respectively. The losses of manure constituents in the portions removed are as follows:—N, 510; P_2O_5 , 172; K_2O , 195, and CaO, 486 grams. The yearly application of 100 kilos. of farmyard manure to each tree supplies sufficient nitrogen and phosphoric acid, and an excess of potash. Artificial manures may be applied in the following amounts: Sodium nitrate, 3.5; 16 per cent. superphosphate, 1.1; and potassium chloride, 0.4 kilo. per tree per annum.

N. H. J. M.

Composition of the Gas Confined in Farmyard Manure. By PIERRE P. DEHÉRAIN and C. DUPONT (*Ann. Agron.*, 1900, 26, 273—294. Compare Abstr., 1884, 1412).—When farmyard manure is watered with liquid manure, carbon dioxide is rapidly produced even near the

surface, and if the damp condition of the manure is maintained there is practically no loss of ammonia.

Aërobic fermentation takes place at the surface when fresh litter is added to the heap; it is very active and causes the temperature to rise as high as 75°. When the manure contains less than 70 per cent. of moisture, aërobic fermentation extends, and oxygen is present in the lower portions of the heap. Decomposition of nitrogenous matter with elimination of free nitrogen may then take place. It is of importance for the manure to become consolidated either by being trampled on by cattle or by being watered with liquid manure.

Hydric fermentation occurs when air penetrates the manure with difficulty; nitrogen is sometimes liberated; carbon dioxide is often produced along with hydrogen, and this suggests that the liberation of hydrogen is accompanied by the production of acids, such as butyric and acetic, capable of decomposing carbonates. Hydrogen is only readily liberated when the manure is neutral or slightly acid, and is no longer produced when the manure is rendered alkaline by addition of liquid manure.

When manure is sufficiently consolidated to exclude air, carbon dioxide and methane alone are produced. Loss of nitrogen cannot take place, as even if nitrogenous matter is decomposed, ammonia alone will be produced and the great excess of carbon dioxide prevents the dissociation of the ammonium carbonate (compare Abstr., 1899, ii, 800).
N. H. J. M.

Phosphoric Acid in Presence of Saturated Solutions of Calcium Hydrogen Carbonate. By TH. SCHLOESING (*Compt. rend.*, 1900, 131, 211—215).—When a small quantity of phosphoric acid is added to a saturated solution of calcium carbonate in water containing carbon dioxide, there is no immediate precipitation, but if the carbon dioxide is expelled by means of a current of air, hydrated tricalcium phosphate is precipitated. Magnesium carbonate behaves in a similar manner.

If phosphoric acid is added in excess, the precipitate is a mixture of di- and tri-calcium phosphates, or consists of the crystallised dicalcium phosphate only, $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$, which is somewhat soluble in water containing carbon dioxide, provided that calcium carbonate is not also present.

The author concludes that superphosphates, when applied to soils, become converted into insoluble tricalcium phosphate mainly by the action of water containing calcium carbonate in solution, either with or without carbon dioxide. On the other hand, phosphates in solution in natural waters become precipitated in the form of tricalcium phosphate when they percolate through rocks and soils containing calcium carbonate, or when they come in contact with water containing calcium carbonate in solution.
C. H. B.

Solubility of the Phosphoric Acid of Basic Slag and Crude Phosphates in Peat Soils. Dependence of the Solubility on the Amount of Free Humic Acid in the Soil. By H. MINSEN and BRUNO TACKE (*Bied. Centr.*, 1900, 29, 447—448; from *Landw. Jahrb.*, 1898, *Erg.-bd.*, iv, 392).—The solubility of phosphoric acid

in peat soil depends on the amount of free humic acid present, and the application of lime in the usual amounts greatly diminishes the solubility of phosphoric acid, except in the case of basic slag.

The phosphoric acid of basic slag which is insoluble in citric acid is less soluble in peaty soil than that of crude phosphates, but seems to be more soluble in partially neutralised soil the more citrate-soluble the original slag.

Although the solubility of phosphates no doubt increases with increasing amounts of free humic acid in the soil, the numerical agreement is affected by the absorption by the soil of some of the phosphoric acid previously dissolved.

N. H. J. M.

Analytical Chemistry.

Examination of Sea Water by an Optical Method. By J. J. MANLEY (*Proc. Roy. Soc. Edin.*, 1900, 23, 35—43).—The relative densities and relative deviations of five samples of sea water of nearly equal total salinity have been determined. By relative deviation is meant the ratio S_D/W_D , where S_D and W_D are the minimum deviations of the D line by sea water and distilled water respectively, with a selected prism and at a standard temperature. The determination of relative deviations is recommended as a method of estimating the relative salinity of sea waters. The order of salinity of the five samples examined is the same whether the method of relative densities or relative deviations be employed; the latter method is at least as dependable, and much more rapid.

J. C. P.

Qualitative Analysis of the Ammonium Sulphide Group. By FERDINAND JEAN (*Chem. Centr.*, 1900, i, 1104; from *Ann. Chim. anal. appl.*, 1900, 5, 125—128).—The scheme is intended for solutions containing nickel, cobalt, iron, zinc, chromium, manganese, aluminium, and phosphates, borates, or silicofluorides of barium, strontium, calcium, and magnesium. After removal of any metals precipitable by hydrogen sulphide, the filtrate is evaporated to dryness in a platinum dish and the residue heated with strong sulphuric acid; the mixture is diluted with water, an equal volume of alcohol added, and the sulphates of the alkaline earths and any silica from silicofluorides are filtered off.

The filtrate freed from alcohol is mixed with 20—25 c.c. of concentrated ammonium citrate solution, ammonium chloride, and excess of ammonia, and strongly shaken. A precipitate indicates phosphoric acid and magnesia. If no precipitate is formed, a portion of the mixture is tested with sodium phosphate for magnesia, and another portion with magnesium chloride for phosphoric acid. If phosphoric acid is present, it is completely precipitated by further addition of magnesium chloride, the filtrate evaporated and the residue calcined.

in a platinum dish, dissolved in hydrochloric acid, and precipitated with ammonia and ammonium sulphide. This precipitate is treated with a mixture of 1 part of hydrochloric acid and 5 parts of water saturated with hydrogen sulphide which redissolves it with the exception of the sulphides of nickel and cobalt. The solution is heated with a little potassium chlorate and then boiled with excess of sodium hydroxide. Zinc is detected in the filtrate by means of hydrogen sulphide and aluminium by acidifying with hydrochloric acid and adding ammonia. A small portion of the precipitate caused by the sodium hydroxide is well washed and then tested for iron with potassium ferrocyanide. The other portion is boiled in a test-tube with nitric acid and lead dioxide; in the presence of manganese, it turns violet, and in the presence of chromium, yellow. In the first case, the filtered liquid is mixed with oxalic acid, which destroys the manganese colour and then shows any yellow colour due to chromium which may then be further tested with acetic acid and lead acetate; in the second case, the residue in the test-tube is washed a few times by decantation and boiled again with lead dioxide and nitric acid, when manganese will again give a violet colour.

The insoluble sulphates are repeatedly boiled with solution of sodium carbonate, and the residue is dissolved in hydrochloric acid. In one portion of the solution, barium is tested for by means of hydrofluosilicic acid; some alcohol is added and the filtrate examined for strontium by the flame-test. In another portion, any barium or strontium is precipitated with ammonium sulphate, and the filtrate is then tested for calcium with ammonium oxalate. L. DE K.

Standardising Normal Acids. By HERMANN THIELE and R. RICHTER (*Zeit. angew. Chem.*, 1900, 486—489).—The authors have noticed that when acids are standardised by means of Iceland spar, the results are slightly higher than when sodium carbonate is used. As the result of a lengthy investigation, using pure materials, they find themselves unable to account for this phenomenon. L. DE K.

Necessary Precautions in certain Acidimetric Estimations. By LOUIS MAGNIER DE LA SOURCE (*Chem. Centr.*, 1900, i, 1103—1104; from *Ann. Chim. anal. appl.*, 1900, 5, 121—125).—When titrating acids, using phenolphthalein as indicator, it is not a matter of indifference whether the operation is performed cold or hot, as the reaction is more sensitive in the cold. Moreover, some kinds of glass yield to hot water a distinct trace of alkali. When estimating sulphuric acid, it does not matter whether a strong or a more dilute solution is titrated, but when dealing with tartaric acid a strong solution should be used, otherwise the results will be too low. L. DE K.

Iodometric Experiments. By GUNNER JÖRGENSEN (*Zeit. anorg. Chem.*, 1900, 24, 183—187).—The reaction between potassium iodate, sodium thiosulphate, and hydrochloric acid takes place according to the equations: $\text{KIO}_3 + 6\text{HCl} + 6\text{Na}_2\text{S}_2\text{O}_3 = \text{KI} + 6\text{NaCl} + 3\text{Na}_2\text{S}_4\text{O}_6 + 3\text{H}_2\text{O}$ and $4\text{KIO}_3 + 3\text{Na}_2\text{S}_2\text{O}_3 + 3\text{H}_2\text{O} + \text{HCl} = 4\text{KI} + 6\text{NaHSO}_4 + \text{HCl}$. The ratio between the amounts of sulphuric acid and tetrathionic acid is dependent on the time allowed for the reaction. The results con-

firm the author's earlier work (Abstr., 1899, ii, 248), and are not dependent on the formation of iodine chloride as stated by Fessel (Abstr., 1899, ii, 802), since it is immaterial whether sulphuric acid or hydrochloric acid is employed.

E. C. R.

Improvement in Péligot's Absorption Apparatus for Ammonia Estimations. By F. PANNERTZ (*Zeit. anal. Chem.*, 1900, 39, 318—320).—The lower bulb of the Péligot U-tube is connected by a narrow tube inserted at the top of the bulb with the upper part of the first limb of the U-tube. By this means, all regurgitation of the absorbing liquid, occasioned by sudden condensation in the distilling flask, is prevented.

M. J. S.

Estimation of Sulphur Dioxide in Sulphites and Thio-sulphates. By MARTIN L. GRIFFIN (*J. Soc. Chem. Ind.*, 1900, 19, 321—323).—The author's experiments indicate that there is no need to strictly follow Bunsen's instructions regarding dilution when titrating sulphur dioxide with iodine, as it is oxidised equally satisfactorily in strong and weak solutions.

Sulphurous acid should be titrated in a closed bottle provided with a U-tube containing a little iodine solution and serving as a trap for any sulphur dioxide which may evaporate; there is but little fear of loss by oxidation. Some sulphites, notably the sodium salt, are so rapidly oxidised by atmospheric oxygen that they should be at once introduced into a vessel containing iodine solution without previous solution or dilution; the excess of iodine is then titrated with sodium thiosulphate.

L. DE K.

Detection of Nitrous Acid in Water. By H. MENNICKE (*Zeit. angew. Chem.*, 1900, 711—719).—The author has compared the relative sensitiveness of the reagents most frequently used for the detection and estimation of nitrous acid in water, namely, solutions of starch-potassium iodide or zinc iodide, the four modifications of Griess' reagent, Riegler's reagent, and Erdmann's reagent (this vol., ii, 243). The results are recorded in two tables, and the conclusion reached is that Erdmann's test is almost free from sources of error and the most delicate of those examined.

L. DE K.

Analysis of Nitric Acid and Mixed Acid [Nitric and Sulphuric]. By ARTHUR P. VAN GELDER (*J. Soc. Chem. Ind.*, 1900, 19, 508—509).—*Analysis of Nitric Acid.*—About 10 grams of the acid are weighed out in a bottle, which is then opened in a funnel under water, and the solution diluted to 1 litre. 100 c.c. of the solution are titrated with $N/3$ alkali, and the total acidity is calculated as nitric acid. To estimate the amount of the lower oxides, 10 c.c. of the original acid are diluted to 100 c.c., and titrated with $N/10$ permanganate.

Analysis of Mixed Acid.—In this case 100 c.c. of the solution are evaporated on a water-bath with the aid of a slight blast of air until the nitric acid has been driven off. A little boiling water is added, and the evaporation continued for 10 minutes; this is repeated three times so as to break up any combined nitrogen oxides. The residual liquid is then titrated, and the difference between the two titrations

represents the total nitric acid. The lower oxides are estimated as before, although the estimation may be interfered with by the presence of arsenic.

To obtain the original hydrogen nitrate in nitric and mixed acid, the amount of nitric acid corresponding with the nitrous acid found by titration with permanganate should be deducted from the total amount; to obtain the available nitric acid, only half the amount of nitrous acid should be allowed for.

L. DE K.

Elimination of Arsenic from the System from a Toxicological Standpoint. By D. SCHERBATSCHOFF (*Chem. Centr.*, 1900, i, 1040; from *Viertelj.-Schr. gerichtl. Med. u. Oeff. Sanitätsno.*, 1900, [iii], 19, 232—262).—Experiments with a rabbit and a dog showed that the arsenic was more rapidly eliminated from the system of the former than of the latter, hence no conclusion should be drawn as to what would happen in animals of a different species or in human beings.

The arsenic was tested for as follows: 20—30 grams of the substance were heated in a Kjeldahl flask with 20—30 c.c. of pure sulphuric acid and a little copper oxide, the solution was diluted with water, boiled to expel any sulphur dioxide (finally with addition of potassium permanganate), and then tested in Marsh's apparatus. When the substance contains much chlorides, some of the arsenic may volatilise; this may be prevented by moistening the mass first with ammonium sulphide, and then heating with a mixture of nitric and sulphuric acids.

L. DE K.

The Carbon Dioxide of the Atmosphere. By EDMUND A. LETTS and ROBERT F. BLAKE (*Sci. Proc. Roy. Dubl. Soc.*, 1900, N. S. 9, ii, 107—270).—In Pettenkofer's method for the estimation of carbon dioxide in the atmosphere, an important source of error is introduced by the employment of barium hydroxide, which, when kept in glass vessels, rapidly causes a superficial corrosion, and then becomes contaminated with alkalis and silica from the glass. The presence of the former causes an increase in alkalinity, and the latter interferes with the proper end reaction when titrating the excess of barium hydroxide, using phenolphthalein as indicator. Another source of error is the difficulty of preparing distilled water free from carbon dioxide, as the distillate from water rendered alkaline with sodium hydroxide rapidly absorbs it from the air. The chief source of error, however, leading to results about 30 per cent. too high, is caused by the absorption of carbon dioxide from the atmosphere and breath during the transfer of the absorbent from the receiver, and its subsequent titration in open vessels. The authors have succeeded in avoiding these sources of error by using the following process.

The standard barium hydroxide solution is preserved in a reservoir attached in the usual way to a bulb-shaped pipette delivering exactly 50 c.c., and provided with a stopcock. The reservoir is, as usual, provided with a soda-lime tube, which is closed when the apparatus is not being used. To prevent any action of the baryta on the glass, the inside of the reservoir, and also the lower part of the glass siphon tube, is coated with paraffin wax. The air to be examined is collected in a narrow-necked, tall jar holding about 6 litres, and also

coated inside with paraffin wax. Through the indiarubber cork pass two glass tubes, one of which is bent at a right angle, and both can be closed when required by plugs consisting of short glass rods attached to pieces of indiarubber tubing. The jar is filled by connecting it with an exhausting syringe attached to an indiarubber tube 12 feet long, so that there is no danger of the collecting area being contaminated by the breath of the operator. A pump is used which removes about 200 c.c. at each stroke, so when 100 strokes have been given, the air originally present in the bottle will have been completely displaced by the air to be tested. The plug of the straight tube is now temporarily replaced by a soda-lime tube, the rubber junction being pinched between the finger and thumb during the operation to prevent access of air. After removing the other plug with the same precaution, the rubber is connected with the pipette, and 50 c.c. of the baryta solution are introduced. After replacing the plugs with the same precautions, the receiving jar is placed on its side for some hours, and frequently rolled about so as to ensure complete absorption of the carbon dioxide.

The receiver is now inverted and clamped to a retort stand, a soda-lime tube attached to the straight tube, and the bent tube connected, with the usual precautions, to the titrating vessel. This consists of a ball-shaped, narrow-necked glass flask, furnished with a two-way stopcock, which communicates with a straight tube, and also with a bent tube, which may be connected with an air-pump. After exhausting the flask, it is connected with the receiving vessel, the stopcock is turned, and the liquid runs into the flask. The last traces of the liquid are removed as follows. The titrating vessel is first removed, and a glass-rod plug substituted for it. The receiver is unclamped and placed upright, and the nozzle of a measuring pipette filled with water containing a little phenolphthalein and carefully neutralised with barium hydroxide is now inserted instead of the plug. On opening the stopcock attached to the pipette, the water runs into the receiver, which, after being well rinsed, is again placed in the former position and connected with the titrating flask; the rinsings are then added in the way described.

The titrating flask is now connected with a delicate burette containing a solution of pure oxalic acid of such a strength that 1 c.c. represents 0.1 c.c. of carbon dioxide at N.T.P. The barium hydroxide solution, which should be titrated about the same time, should, if possible, correspond exactly in strength with the acid.

The test-analyses made with pure air mixed with definite volumes of carbon dioxide are very satisfactory.

The paper contains a summary and bibliography of previous work on the subject.

L. DE K.

Liquid Carbon Dioxide. By G. HOLSTE (*Zeit. anal. Chem.*, 1900, 39, 243—245; from *Zeit. gesamt. Kohlensäure Ind.*, 3, 461).—The principal gaseous impurities in commercial liquid carbon dioxide are nitrogen and oxygen, which remain gaseous in the storage cylinder. A sample of the gas taken when the cylinder is placed with the valve uppermost will therefore have a different composition from

one taken when the cylinder is inverted or laid horizontally. Both should be analysed. A convenient eudiometer for the purpose is described, and a method for calculating the average composition of the contents of the cylinder is given.

M. J. S.

Preparation of Sodium Cobalt Nitrite, and its Employment for the Detection of Potassium. By EINAR BILLMANN (*Zeit. anal. Chem.*, 1900, 39, 284—289. Compare Adie and Wood, *Trans.*, 1900, 1076).—For the detection of potassium in presence of much sodium, a solution of pure sodium cobalt nitrite is more sensitive than the spectroscope itself. To prepare the reagent, 150 grams of sodium nitrite are dissolved in 150 c.c. of warm water, and the solution cooled to 40—50°; 50 grams of crystallised cobalt nitrate are added, and then gradually 50 c.c. of 50 per cent. acetic acid, the mixture being vigorously shaken. A brisk current of air is then passed through the mixture for half-an-hour. The mixture is allowed to subside during two hours, and then filtered. The clear filtrate and washings, amounting in all to 300 c.c., are precipitated by the gradual addition of 250 c.c. of 96 per cent. alcohol. The salt is collected on a suction filter, washed four times with 25 c.c. of alcohol, twice with 25 c.c. of ether, and air-dried. For use, 0.3—0.5 gram is dissolved in 2—3 c.c. of water, and added cold to the solution to be tested. This solution must contain only potassium and sodium as chlorides, nitrates or sulphates, and must be free from phosphates, mineral acids, or caustic alkalis. Small amounts of acetic acid, alkali carbonates, magnesium, and calcium salts do not greatly impair the sensitiveness. It is possible with this reagent to detect 0.0009 milligram of potassium in presence of 2363 parts of sodium. The reagent is not permanent when dissolved; the solution must be prepared when required.

M. J. S.

The Estimation of Zinc as Phosphate. By H. D. DAKIN (*Zeit. anal. Chem.*, 1900, 39, 273—284).—Guyard ["Hugo Tamm"], who first proposed the estimation of zinc as zinc ammonium phosphate (*Abstr.*, 1871, 1214), admitted the existence of several sources of error, and did not furnish proof analyses of pure substances. Austin, who supplied this deficiency (this vol., ii, 49), assumed that the presence of at least 10 per cent. of ammonium chloride in the solution was essential. The author, starting with zinc oxide purified with great care, shows by numerous proof analyses that accurate results can be obtained without the use of large quantities of ammonium chloride. The use of ammonium phosphate, instead of sodium phosphate, avoids the error caused by the presence of sodium in the precipitate. Traces of zinc can generally be detected in the filtrate by ammonium sulphide, but never more than 2—3 decimilligrams. The precipitate, dried for 2 hours at 100—105°, has the composition ZnNH_4PO_4 ; it suffers no loss by prolonged drying at this temperature, and can be accurately converted into zinc pyrophosphate by gradual heating in an open crucible. If rapidly exposed to a red heat, reduction takes place. The following method of precipitation is recommended. The acid zinc solution, in a platinum basin, is nearly neutralised with ammonia, diluted to 150 c.c., and heated on the water-bath. About 10 parts of ammonium

phosphate for each part of zinc supposed to be present are added, and the heating is continued for a quarter of an hour. After a little further delay ($\frac{1}{2}$ —24 hours) the precipitate is collected on an asbestos filter in a Gooch crucible, washed thoroughly with a hot 1 per cent. solution of ammonium phosphate, and the latter removed by several washings with aqueous alcohol. It is then dried and weighed, or, if ignition is preferred, the Gooch crucible is placed inside a platinum crucible. The precipitate is then removed from the filter by dilute nitric acid, and the crucible dried (or ignited) as before. This mode of obtaining the tare is preferable to weighing the crucible before filtration, as the phosphate solution slightly attacks the asbestos. The results were as accurate when only 1 gram of ammonium chloride was present, as with 10 or 20 grams. A large amount hastens the crystallisation of the precipitate, but introduces inconvenience in the washing.

M. J. S.

Detection of Sodium in the Presence of Potassium. By N. SCHOORL (*Chem. Centr.*, 1900, i, 1140; from *Ned. Tijdschr. Pharm.*, 1900, 12, 116—118).—The microchemical test for sodium by means of uranyl acetate is interfered with by the presence of much potassium. The author now proposes to evaporate a few times with perchloric acid, and then to extract with alcohol. Potassium perchlorate remains undissolved, and the filtrate contains the sodium which may then be tested for by the uranium method.

L. DE K.

Colour Reactions for Detecting Calcium Salts in Organic Tissues. By VALENTINO GRANDIS and C. MAININI (*Atti Real. Accad. Lincei*, 1900, [v], 9, i, 280—283).—The piece of tissue or section is placed in a saturated alcoholic solution of purpurin and left until it is strongly coloured, the time required being from 5 to 10 minutes. When removed from the solution, it is not uniformly coloured, but exhibits dark patches which are hard. These dark patches, due to the deposition of the colour on salts of calcium, usually the carbonate and phosphate, may be made clearer by immersion for a few moments in a 0.75 per cent. solution of sodium chloride, which causes the formation of a small quantity of calcium chloride and consequent precipitation of the purpurin in an insoluble form in those positions where calcium salts are present. The coloured tissue is then soaked several times in 70 per cent. alcohol until no more colour is removed.

The presence of calcium salts can also be localised by treating the well-washed tissue with pyrogallol, which is fixed specially on those parts where calcium salts are situated. After remaining in contact with the air for some time to allow the pyrogallol to oxidise, the tissue is washed quickly in water, dried, and preserved in balsam. The presence of calcium salts is denoted by dark brown patches, the remainder of the tissue having only a pale, brownish-yellow colour.

T. H. P.

Detection of Barium, Calcium, and Strontium, and the Action of Ammonium Chloride on Strontium Chromate. By ERNEST DUMESNIL (*Ann. Chim. Phys.*, 1900, [vii], 20, 125—135; *Zeit. Ver. Deut. Zuck.-Ind.*, 1900, 531—537).—The ordinary methods

for detecting the presence of barium, calcium, and strontium in mixtures of salts fail when the proportion of strontium is small. To obviate this difficulty, the following method is proposed. The precipitate, consisting of the mixed carbonates, is dissolved in the least possible quantity of 10 per cent. hydrochloric acid, the solution evaporated to dryness to expel excess of acid, and the residue dissolved in water. To a small portion of the solution, strontium chromate solution is added; the formation of a precipitate indicates the presence of barium. If no precipitate forms, another portion of the neutral liquid is mixed with calcium chromate solution, the formation of a precipitate on warming showing the presence of strontium. If baryta is present, however, the remainder of the neutral chloride solution is precipitated by means of potassium chromate, the liquid being then heated to boiling and filtered; the precipitate is then boiled for a few moments with ammonium chloride solution and filtered. To the clear filtrate sodium carbonate is added, the liquid filtered, the precipitate washed once on the filter, and then treated with 10 per cent. acetic acid. Part of the liquid thus obtained is neutralised with ammonia and then warmed with calcium chromate solution; the formation of a precipitate shows the presence of strontium. Another part of the acetic acid solution is heated with an acetic acid solution of strontium oxalate, by which means any calcium is precipitated.

Ammonium chloride solution dissolves strontium chromate, and the solution deposits orange-yellow, tabular crystals having a composition corresponding with the formula $2(\text{NH}_4)_2\text{Cr}_2\text{O}_7\cdot\text{NH}_4\text{Cl}$. T. H. P.

Action of Carbon Dioxide on the Borates of Barium. By HARMON N. MORSE and D. W. HORN (*Amer. Chem. J.*, 1900, **24**, 105—137).—Jones' adverse criticism (*Abstr.*, 1898, ii, 640) of Morse and Burton's method (*Abstr.*, 1888, 755) of estimating boric acid is valueless, since it is based on experiments made with aqueous, instead of strongly alcoholic, solutions; trustworthy results can be obtained by adhering to the original directions. Contrary to Jones' statement, boric acid is not lost by volatilisation as ethyl borate, when, following the method, the alcoholic liquid containing the insoluble metaborate and excess of barium hydroxide is treated with an excess of carbon dioxide, and then distilled in an atmosphere of the gas; under Jones' conditions, using aqueous solutions, there is also no loss.

In order to obtain satisfactory results with the method, care has to be exercised in heating the mixture of barium borate and carbonate, as, when dried at 100° , it contains no small quantity of water; on drying for about 50 hours at 175° , or, more rapidly, at just below a red heat, it is rendered anhydrous; but on exposure to the air it rapidly absorbs water. At a full red heat the metaborate attacks the carbonate with evolution of carbon dioxide; if from this cause the weight of the mixture is too small, the necessary correction can be made by absorption of carbon dioxide from the air and subsequent drying in a desiccator, or at 500° . When once completely dehydrated, the mixture is comparatively indifferent to atmospheric moisture.

W. A. D.

Cement Testing. By O. H. KLEIN and STEPHEN F. PECKHAM (*J. Soc. Chem. Ind.*, 1900, 19, 644—645).—The authors recommend that the sample should be analysed in the same condition as received, and not dried beforehand, either at a low or high temperature; also that any insoluble matter not volatilised by treatment with hydrofluoric acid should not be called silica, although a small amount may be disregarded (compare Shimer, *Abstr.*, 1899, ii, 520).

L. DE K.

Diphenylcarbazide as a Sensitive Reagent for Metals. By PAUL CAZENEUVE (*Compt. rend.*, 1900, 131, 346—347).—The coloured products formed when diphenylcarbazide is oxidised by metallic salts (this vol., i, 465) furnish very sensitive reactions for the detection of metals, and especially of copper, mercury, and iron. A cold saturated solution of the carbazide in benzene is agitated with the aqueous solution of the salt, or, if the latter solution is not too dilute, an alcoholic solution of the carbazide may be used. Cupric salts yield a violet compound, which dissolves in benzene, and is not affected by agitation with potassium ferrocyanide solution; mercuric salts give a dull blue compound; ferric salts form a peach-flower coloration, which becomes brown if the liquid is agitated with potassium ferrocyanide solution. The reaction will detect 1 part of the metals in 100,000 of solution, and is not given by other metals. The colorations are destroyed by inorganic acids, and by excess of organic acids. Solutions of silver and gold salts yield rose colorations with precipitation of the metal.

If a solution of chromic acid, or a chromate containing 1 part in 1,000,000, or even less, is acidified with dilute hydrochloric acid and mixed with an excess of solid diphenylcarbazide, a splendid violet coloration is developed, stable in presence of inorganic acids, and quite distinct from the reactions already described. No other metal behaves in the same way. The coloured product is not removed from water by benzene, but dissolves in amyl alcohol.

O. H. B.

Action of Sodium Thiosulphate on Mercuric Salts. By FR. FAKTOR (*Chem. Centr.*, 1900, i, 1246; from *Pharm. Post*, 1900, 33, 253—254).—Aqueous solutions of mercuric salts are precipitated at the boiling point by sodium thiosulphate, with formation of mercuric sulphide. One mol. of sodium thiosulphate corresponds with 1 mol. of mercuric chloride. The process may also be applied to mercurous salts.

L. DE K.

Effect of Oxidising Agents on the Reduction of Mercuric Chloride by Oxalic Acid. By J. H. KASTLE and W. A. BEATTY (*Amer. Chem. J.*, 1900, 24, 182—188).—The reduction, in direct sunlight, of mercuric chloride by ammonium oxalate in aqueous solution is greatly accelerated by the presence of a trace of potassium permanganate. Ferric chloride and most other oxidising agents also accelerate the action, but a few, such as chromic acid and potassium chromate or dichromate, retard it. The same substances have a similar accelerating action on the reduction of thallic chloride by ammonium oxalate. The explanation given is that probably the oxidising substance used is reduced by the ammonium oxalate, and

then oxidised again by the mercuric or thallic chloride, thus acting as a "carrier" of oxygen from the oxalate to the chloride.

W. A. D.

Volumetric Estimation of Mercuric Chloride. By ERWIN RUPF (*Arch. Pharm.*, 1900, 238, 298—301).—Twenty c.c. of a solution of mercuric chloride containing about 4 grams per 100 c.c. are shaken for an hour with a little pulverised iron. The liquid is filtered and 10 c.c. are titrated with standard potassium permanganate after adding 5 c.c. of dilute sulphuric acid and 5 c.c. of a 10 per cent. solution of manganous sulphate. One mol. of ferrous chloride represents 1 mol. of mercuric chloride.

If the substance to be tested contains besides mercuric chloride any oxidisable matters or coal-tar colouring matters, potassium permanganate is added in slight excess, and this in turn destroyed by cautious addition of tartaric acid. The resulting ferric chloride is then estimated in the usual way by means of potassium iodide and sodium thiosulphate.

L. DE K.

Composition and Estimation of Cerium Oxalate. By FREDERICK B. POWER and FRANK SHEDDEN (*J. Soc. Chem. Ind.*, 1900, 19, 636—642).—Cerium oxalate has the composition $\text{Ce}_2(\text{C}_2\text{O}_4)_3 \cdot 10\text{H}_2\text{O}$. Commercial cerium oxalate is frequently contaminated with the oxalates of lanthanum and didymium. The former may be recognised by the reddish-brown colour, and the latter by the alkaline reaction of the ash, provided that no other alkaline matters are present. On the other hand, traces of cerium may be detected in the presence of lanthanum and didymium oxalates by heating 0.1 gram of the mixture with 0.5 c.c. of sulphuric acid until all effervescence ceases. The solution is then diluted with 10 c.c. of water, and after adding 1 gram of ammonium persulphate, it is again boiled, a bright yellow colour being developed if cerium is present even in traces (compare von Knorre, *Abstr.*, 1898, ii, 311).

L. DE K.

Colorimetric Estimation of Nickel in Steel. By RUDOLF FIEBER (*Chem. Zeit.*, 1900, 24, 393—394).—A series of standard samples of nickel steel in which the nickel varies from 1 per cent. upwards with a difference of about 1 per cent. between each sample are selected, and of each a solution is made as follows: 6 grams are dissolved in nitric acid, the solution is evaporated to the smallest possible volume, and rinsed into a 200 c.c. flask. The iron is then precipitated with ammonia, and when cold, the liquid is diluted to the mark; after thoroughly shaking, it is filtered and kept in a 200 c.c. flask for future use. Six grams of the sample to be examined are now treated in the same way, and the resulting filtrate is compared as regards its colour with the stock solutions. Should it not correspond with any of these, the one lighter in colour is selected as standard, and the sample is diluted with water until it shows the same colour. The percentage of nickel is then found by a simple calculation. The results are sufficiently accurate for technical purposes. The presence of chromium somewhat interferes with the test.

L. DE K.

Analysis of Titaniferous Iron Ores. By CHARLES BASKERVILLE (*J. Soc. Chem. Ind.*, 1900, 19, 419—420).—Silica is estimated in the usual manner after fusing 1 gram of the ore with 5 grams of sodium carbonate and 1 gram of potassium nitrate. After weighing the crude silica, it is heated with hydrofluoric and sulphuric acids and then reignited; the loss in weight represents pure silica.

Sulphur and phosphorus are estimated by fusing 2 grams of the ore with 20 grams of the above fusion mixture, using 'gasolene' as a source of heat. The fused mass is then extracted with water, and to the filtrate are added 25 c.c. of ferric chloride containing 0.1 gram of metallic iron. Slight excess of hydrochloric acid is added, the liquid boiled, reprecipitated with ammonia, and the sulphuric acid estimated in the filtrate. The phosphoric acid is contained in the iron precipitate, and may be estimated by the molybdate process (Abstr., 1894, ii, 253).

Titanium is estimated by fusing 0.5 gram of the ore with 0.5 gram of sodium fluoride and 5 grams of potassium hydrogen sulphate for 15 minutes. The fused mass is dissolved in boiling water containing 3 c.c. of nitric acid, ammonia is added, and the excess expelled by boiling. The well-washed precipitate is dissolved in dilute hydrochloric acid, and dilute ammonia is added until a slight permanent precipitate is obtained, which is then redissolved in a drop or two of dilute hydrochloric acid (1:100). The titanium is now precipitated as usual by saturating the liquid with sulphur dioxide and boiling for a few minutes; it is then collected, ignited, and weighed as dioxide. When many assays have to be made, Weller's colorimetric process (Abstr., 1883, 381) is preferable. 0.5 gram of the ore is fused with sodium fluoride and potassium hydrogen sulphate as directed, care being taken to completely expel the fluorine; the fused mass is dissolved in water containing 10 per cent. of sulphuric acid, and finally made up to 500 c.c. One hundred c.c. of the filtrate are then mixed with 5 c.c. of hydrogen peroxide, and the colour thus produced is compared with that of a series of ferruginous solutions to which a varying amount of titanium and 5 c.c. of hydrogen peroxide have been added.

Iron is estimated by the dichromate method in the filtrate from the silica.

L. DE K.

Estimation of Benzene and Ethylene in Coal-gas. By FRITZ HABER (*Chem. Centr.*, 1900, 1, 1309—1310; from *Journ. f. Gasbel.*, 43, 347—350).—The author has made further experiments with the process recommended by himself and Oechelhäuser (Abstr., 1897, ii, 128) and has found it to be trustworthy.

L. DE K.

Estimation of Reducing Sugar by Means of a Centrifuge. By PH. CHAPPELLE (*Chem. Centr.*, 1900, i, 1108; from *Ann. Chim. anal. appl.*, 1900 5, 140—145. Compare this vol., ii, 112).—In the presence of several reducing sugars, the total cuprous oxide obtained is not the theoretical quantity. The cuprous oxide corresponding with a single sugar is determined by means of a factor K = cuprous oxide/sugar, which depends on the nature of the sugar and the amount of precipitated cuprous oxide. A table is given for the value

of *K* for 20 to 250 milligrams of cuprous oxide, and for dextrose, invert sugar, and lactose. An example is given showing the estimation of two of these sugars in the presence of each other; the author has not yet succeeded with a mixture containing the three.

The method is also applicable when using Sachsse's alkaline mercuric iodide solution; the mercury should be dried below 150°. The author has somewhat altered the composition of this solution, and prepares it by dissolving 22.7 grams of mercuric iodide, 40 grams of potassium iodide, and 100 grams of sodium hydroxide in water and diluting to 1 litre, and its value for dextrose and invert sugar is given; the solution is, however, sensibly affected by sucrose. L. DE K.

Estimation of Cellulose. By CONSTANTIN COUNCLER (*Chem. Zeit.*, 1900, 24, 368—369).—A criticism of the methods for the estimation of cellulose proposed by Lange, Müller, and Schulze-Henneberg. The results obtained by the first process are far too low. The others give better results, but are so difficult of execution that they are of no practical use. The author's attempt at modifying Müller's process by subjecting the wood to a preliminary treatment with calcium hydrogen sulphite ended in failure. A good and practical process is much to be desired. L. DE K.

Estimation of Cell-wall Constituents, Hemicelluloses, and Cellulose in some Plants and Parts of Plants. By ALBERT KLEIBER (*Landw. Versuchs-Stat.*, 1900, 54, 161—213).—The methods of Lange, Hoffmeister, and F. Schulze for determining cellulose gave unsatisfactory results. Concordant, if not quite satisfactory, results were obtained by boiling the cellulose, obtained by Hoffmeister's or Schulze's method, for 2 hours with 1.25 per cent. sulphuric acid. In the case of Hoffmeister's method, the same results are usually obtained whether boiling with sulphuric acid precedes or follows treatment with chlorate.

Methods for determining the cell-wall constituents are described, in which the substance was extracted with 0.15 and 0.42 per cent. aqueous potassium hydroxide. It is thought that in some cases the results obtained are too high, owing to the presence of insoluble non-nitrogenous substances which do not belong to the cell-wall; on the other hand, the cell-wall itself may be attacked. The results were always higher than obtained with the crude fibre; the crude fibre does not, therefore, include the whole of the cell-wall.

Hemicelluloses are determined by boiling the residues obtained in the estimation of cell-wall constituents with 1.25 per cent. sulphuric acid. The proteids and ash are again determined in the residue. By deducting the non-nitrogenous matter in the residue from the amount of non-nitrogenous matter present before boiling with acid, numbers are obtained representing the amount of non-nitrogenous matter dissolved. The method is, for different reasons, imperfect, but it furnishes useful results. N. H. J. M.

Simple Distinction between Glue and Dextrin or Gum Arabic. By HUGO BORNTRÄGER (*Chem. Centr.*, 1900, i, 1109; from *Oesterr. Chem. Zeit.*, 1900, 3, 188—189).—The suspected product is

heated with 50 per cent. hydrofluoric acid. Glue emits at once an odour of butyric acid. On evaporating on the water-bath, a white mass is obtained which gives the usual alkaloidal reactions with phosphotungstic acid, Nessler's test, and other reagents, but has not been fully investigated by the author. L. DE K.

Estimation of Carvone in Volatile Oils. IV. By F. W. ALDEN and F. G. EHLERT (*Pharm. Archives*, 1900, 3, 9—18).—Further investigation has been made of the influence exerted by the conditions of experiment on the error of the method previously described (this vol., ii, 117). When much resin is present in the oil, the carvoxime will not crystallise, and it is necessary to distil the oil with steam and perform the estimation with the oil that distils over. When there is resin present, but not enough to prevent crystallisation, the crystals are contaminated with it, and in consequence the result is considerably too high. Better crystals are obtained if the sodium hydrogen carbonate is used in amount exactly equivalent to the hydroxylamine hydrochloride, instead of in excess, and also if a large excess of hydroxylamine is avoided. C. F. B.

Oxidation [of Oxalic Acid by Potassium Permanganate]. By GEORG VON GEORGIEVICS and L. SPRINGER (*Monatsh.*, 1900, 21, 413—421).—When an oxalic acid solution is titrated with a solution of potassium permanganate in presence of sulphuric acid, it is always observed that the beginning of the reaction is very slow, but afterwards the permanganate is instantly decolorised. The following explanation of this is suggested. The first few drops of the permanganate solution are slowly reduced to manganese sulphate; this at once reacts with an excess of permanganic acid, forming manganese dioxide, which is instantly reduced by oxalic acid. R. H. P.

Mercurisalicyclic Acid and Millon's Reaction. By CARL J. LINTNER (*Zeit. angew. Chem.*, 1900, 707—711).—When mercuric salicylate is heated for some time at 110° or boiled with water, it is decomposed into salicylic acid, which either volatilises or dissolves, and a compound formerly regarded by Lajoux and Grandval (*Abstr.*, 1893, i, 642) as a basic salicylate, but now described as mercurisalicyclic acid, $(C_7H_5O_2)_2Hg = C_7H_5O_8 + C_7H_4HgO_3$. The latter is monobasic, dissolves without separation of mercury in aqueous sodium hydroxide or ammonium sulphide, and when boiled with water and sufficient sulphuric, hydrochloric, or nitric acid to obtain a clear liquid, gives, with sodium nitrite, a yellow colour which changes to red on adding mercuric nitrate solution. When testing for salicylic acid with Millon's reagent, mercurisalicyclic acid is probably formed on boiling with mercuric nitrate, and this, in contact with nitrous acid, gives a nitroso-compound soluble with a red colour in excess of mercuric nitrate.

The action of Millon's reagent is solely due to mercuric nitrate and nitric and nitrous acids; mercurous nitrate is inert. The best way of detecting salicylic acid by its aid is as follows: The solution is boiled with a few drops of a 10 per cent. solution of acid mercuric nitrate for 2 minutes, 2—3 drops of dilute sulphuric acid

are added, and then a few drops of a solution of sodium nitrite. The red colour shows immediately. Proteids may be similarly tested for.

L. DE K.

Commercially Pure Oleic Acid and Purified Oleic Acid. By HUGO DITZ (*Chem. Zeit.*, 1900, 24, 462—464).—Many samples of oleic acid contain a small percentage of an oily, slightly volatile, and unsaponifiable substance, varying in composition, and absorbing a considerable amount of iodine; the presence of this substance causes the turbidity noticed when titrating the sample in the usual way with alkali. From the author's investigation, it is probably an impurity introduced during the process of manufacture, and not gradually formed during the storage of the acid.

L. DE K.

Estimation of Tannic and Gallic Acids. By FERDINAND JEAN (*Chem. Centr.*, 1900, i, 1107—1108; from *Ann. Chim. anal. appl.*, 1900, 5, 134—140).—2·7 grams of iodine and 5—6 grams of potassium iodide are dissolved in water to a litre and the solution is standardised, first with a 0·1 per cent. solution of tannin, and then also with gallic acid. Ten c.c. of either solution are mixed with 5 c.c. of a cold saturated solution of sodium hydrogen carbonate contained in a beaker having a 50 c.c. mark. The iodine is slowly run in until a drop of the liquid strikes a blue colour on paper impregnated with dry starch; the liquid is now diluted to 50 c.c., and more iodine added until a blue spot is again formed. The solution of the iodine is of the requisite strength when 10 c.c. of the tannin requires 10—10·5, and 10 c.c. of the gallic acid 13 c.c. of iodine. A blank experiment showing the effect of the dilute alkali should also be made; this will generally amount to 0·4 c.c.

The decoction to be tested should contain about 0·1 per cent. of tannin, and 10 c.c. are titrated as described. Another portion is then treated as follows: Fifty c.c. are mixed in a 100 c.c. flask with 15 c.c. of a solution of albumin (2 grams of albumin rubbed to a thick paste with strong glycerol, and afterwards diluted with water to a litre), 20 grams of sodium chloride, and water added up to the mark. Twenty c.c. of the filtrate are then freed from albumin by adding a drop of acetic acid and boiling; the filtrate is titrated as before, allowance being made for the influence exercised by the salt and albumin as found by another blank experiment. The difference between the two titrations represents the tannin, whilst the second titration represents the gallic acid.

Tanning materials containing soluble starch are exhausted with alcohol. Sulphites may be allowed for by titrating with iodine in an acid solution.

L. DE K.

Rapid Estimation of the Iodine Number of Fats. By J. BELLIER (*Chem. Centr.*, 1900, i, 1109; from *Ann. Chim. anal. appl.*, 1900, 5, 128—131).—When dealing with fats having a somewhat varying iodine number and where consequently no need exists for an accurate estimation, the author uses the following process:

One gram of the fat is dissolved in 20 c.c. of a mixture of equal vols. of glacial acetic acid and chloroform previously saturated with mercuric chloride. After adding 10 c.c. of a 10 per cent. solution of potassium

iodide (1 dissolved in acetic acid) the mixture is titrated with the iodine solution until it is permanently coloured for 5 minutes. This iodine solution is prepared as follows: 50 grams of iodine and 10.2 c.c. of bromine or 33.5 grams of iodine and 13.5 c.c. of bromine are dissolved in 950 c.c. of glacial acetic acid and the liquid is saturated with mercuric chloride. After a few days, 5 c.c. of either of the solutions (the second one acts the quicker, but gives off fumes) is titrated with sodium thiosulphate and then diluted with acetic acid to such an extent that 1 c.c. represents exactly 0.1 gram of iodine.

More accurate results may be obtained by adding a large excess of the reagent to the solution of the fat and then titrating the excess with thiosulphate.

L. DE K.

Iodine and Bromine Values of Oils and Fats. By ROWLAND WILLIAMS (*J. Soc. Chem. Ind.*, 1900, 19, 300—301).—A table giving the iodine value by Wijs' solution, the calculated bromine value, the same as found by direct experiment, the bromine addition value, and the bromine substitution value of cocoanut oil, tallow, butter-fat, lard, castor oil, rape oil, two samples of cotton-seed oil, two samples of maize oil, japanese wood oil, menhaden oil, and nine samples of linseed oil.

Wijs' method gives excellent results if care is taken to add at least twice the amount of iodine likely to be absorbed. In some cases, notably with linseed oil, there are great discrepancies between the calculated and experimentally found bromine values.

L. DE K.

Linseed Oil Analysis. By PARKER C. McILHINEY (*J. Soc. Chem. Ind.*, 1900, 19, 320—321).—The author recommends the determination of the sp. gr. and the bromine addition and substitution numbers (this vol., ii, 178). If unsatisfactory, a portion of the sample should be distilled in a current of steam and the distillate examined for turpentine, petroleum, &c. The volatile matter may easily be separated from the aqueous layer and measured or weighed. For the separation of turpentine and petroleum, Burton's nitric acid process is recommended (*Abstr.*, 1890, 669). The non-volatile matter is then collected and dried. Its acidity figure is taken, and if found to be very high, points to the presence of rosin, which must then be estimated by Twitchell's method (*Abstr.*, 1892, 389). Another portion is treated in the usual way for unsaponifiable matter (rosin oil, mineral oil). This and the distillation test are no doubt the most valuable and conclusive, as they allow of the actual separation of some of the adulterants. Finally, the saponification figure may prove to be of value.

L. DE K.

Refractometric Butter Analysis. By ALFRED PARTHEIL and J. VON VELSEN (*Arch. Pharm.*, 1900, 238, 261—279).—The authors have redetermined the refractive index of different fatty compounds at various temperatures, using sodium light, and have calculated the temperature coefficients and molecular refractions. The following compounds were tested: triacetin, tributyrin, trilaurin, tripalmitin, tristearin and triolein. Samples of butter-fat, margarin, ground-nut

oil, olive oil, cotton-seed oil, and sesamé oil were also examined and the results are recorded.

It is shown that the refraction of butter increases with the iodine figure, but not to the extent expected with the Reichert-Meissl number; there is also no fixed relation between the latter and the temperature coefficient.

L. DE K.

Normal Refractometric Value for Butter. By A. LAM (*Chem. Zeit.*, 1900, 24, 394—395).—The limit of refraction of butter at 40° has been fixed in Germany at 44.2. The author, as the result of a large number of analyses of butters of Dutch origin and undoubted genuineness, states that for these butters the limit should be fixed at 46.

L. DE K.

Rancidity of Butter. By Jos. HANUŠ (*Zeit. Nahr.-Genussm.*, 1900, 3, 324—328).—A butter was again analysed after having been exposed for three months to the action of air and light. The iodine, Reichert-Meissl, and saponification numbers were but little affected, but the acidity had increased from 5.1 (?) to 75.2 c.c. of N/10 soda per 100 grams of butter fat.

The sample was melted, the fat dissolved in ether, and neutralised with sodium hydroxide, using phenolphthalein as indicator; the soaps were dissolved by shaking with water at 25°, the solution was evaporated to dryness and traces of fat removed by washing with light petroleum. After completely drying the soap, a large portion was dissolved in an Erlenmeyer flask in 150 c.c. of water, 15 c.c. of dilute sulphuric acid (1:5) were added, and the whole distilled in a current of steam until the volatile acid had completely passed over; the distillate was then titrated. The neutralised solution was evaporated, the residue dried at 100° and weighed, and the percentage of volatile acids calculated by Henriques' formula (*Abstr.*, 1899, ii, 258).

The non-volatile acids were estimated by Hefner's method and their molecular weight calculated from the saturation number. The unsaturated acids were calculated indirectly from the formula $100I/90.07$, where I represents the iodine number. The result was 2.10 per cent. of volatile acids with a mol. weight of 104; saturated non-volatile acids, 40.90; unsaturated non-volatile acids, 26.20; joint mol. weight, 278. From these data, the relation of the volatile and non-volatile acids in the isolated free acids is 1:32 (*a*), of the unsaturated to the saturated acids 1:1.5 (*b*), of the volatile to the unsaturated acids 1:13 (*c*), and to the saturated acids 1:20 (*d*). Assuming that fresh butter contains on an average 5.5 per cent. of volatile, 33 per cent. of unsaturated, and 53 per cent. of saturated acids, then $a' = 1:16$, $b' = 1:1.6$, $c' = 1:6$, and $d' = 1:9.6$.

The acidity of four fresh butters was taken and also the acidity of the distillates; the proportion of the latter to the former was approximately as 1:10, but after they had become rancid the proportion was about as 1:25.

These experiments show that the glycerides of both series of acids (volatile and non-volatile) are hydrolysed during the exposure of the butter, the non-volatile acids being set free sooner and in larger pro-

portion than the volatile ones. The glycerides of the saturated and unsaturated acids seem to be equally affected.

There is little doubt that the peculiar taste and odour of rancid butter is partly due to traces of aldehydes.

L. DE K.

Detection of "Saccharin" [*o*-Benzoic sulphinide] in Articles of Food. By J. DE BRÉVANS (*Chem. Centr.*, 1900, i, 1105; from *Ann. Chim. anal. appl.*, 5, 131—133).—Truchon's process (this vol., ii, 377) when applied to some kinds of wine and beers or to infusion of liquorice gives untrustworthy results owing to the presence of tannins soluble in the ether-petroleum mixture. The following modification is proposed. The liquid is mixed with an excess of ferric chloride and then with a slight excess of calcium carbonate. The filtrate is then treated as directed. No 'saccharin' is retained by the iron precipitate and a subsequent violet colour is exclusively due to the presence of 'saccharin.'

L. DE K.

Estimation of Sugar in Diabetic Urine. By JULIUS TROEGER and W. MEINE (*Arch. Pharm.*, 1900, 238, 305—309).—The copper solution used by the authors differs from the ordinary Fehling's solution by containing 100 grams of glycerol per litre instead of Rochelle salt. Its exact strength in copper is determined by weighing this as subsulphide.

Sixty c.c. of the copper solution are heated in a porcelain basin with 5—20 c.c. of the sample of urine for 15 minutes. The liquid is made up to 100 c.c. in a measuring flask graduated at 45°, the warm liquid is shaken with a little talc to remove the suspended cuprous oxide, and then rapidly filtered. By estimating the copper as subsulphide in an aliquot part of the filtrate, the amount of copper oxide which has been reduced by the dextrose may be found.

L. DE K.

Estimation of Oxalic Acid and the Occurrence of Oxaluric Acid in Urine. By ERNST SALKOWSKI (*Zeit. physiol. Chem.*, 1900, 22, 437—460).—The author states that the usual process of estimating oxalic acid in urine by direct precipitation with calcium chloride in the presence of ammonia and free acetic acid gives results which are too low and proposes the following method.

500 c.c. of unfiltered urine are concentrated to about one-third. When cold, 20 c.c. of hydrochloric acid are added and the mixture is shaken three or more times in succession with 200 c.c. of a mixture composed of 9—10 vols. of ether and 1 vol. of alcohol. The united ether extract is passed through a dry filter and the ether recovered by distillation. The residual alcoholic liquid is poured into a deep basin, 10—15 c.c. of water are added, and the whole heated until the alcohol has evaporated and the liquid become clear. After filtering, the liquid is rendered faintly alkaline with ammonia and then again faintly acid with acetic acid; if this should produce a turbidity, the liquid must be again filtered. The oxalic acid is now precipitated by adding 2 c.c. of a 10 per cent. solution of calcium chloride and after 24 hours the calcium oxalate is collected, converted into oxide and

weighed. The same process may be applied to the estimation of oxalic acid in tissues.

It was accidentally discovered that the amount of oxalic acid is much increased by evaporating urine with hydrochloric acid to a syrupy consistence. 750 c.c. of a urine which yielded 6.1 milligrams of calcium oxide gave 10.2 milligrams when evaporated with 20 c.c. of hydrochloric acid. This increase is due to the hydrolysis of oxaluric acid by the hydrochloric acid. This oxaluric acid seems, according to the author's experiments, to exist in a pre-formed condition and to a larger extent than hitherto believed. If larger quantities of urine are evaporated, there is a danger of some of the oxalic acid being reconverted into oxaluric acid.

L. DE K.

A Quantitative Reaction of the Ureides and Purine Derivatives. II. By ADOLF JOLLES (*Ber.*, 1900, 33, 2119—2121. Compare this vol., ii, 454).—When oxidised with permanganate and sulphuric acid under the conditions already described, caffeine, hydroxycaffeine, theophylline, paraxanthine, and heteroxanthine yield as many mols. of methylamine as they contain methyl groups; the rest of the nitrogen is obtained as carbamide in the case of caffeine and hydroxycaffeine, as ammonia in the case of paraxanthine and heteroxanthine, and to about an equal extent as carbamide and as ammonia in the case of theophylline. In the case of heteroxanthine, when only about one-quarter the usual quantity of sulphuric acid was employed a very considerable amount of carbamide was formed.

C. F. B.

Estimation of Allantoin in Urine. By OTTO LOEWI (*Zeit. anal. Chem.*, 1900, 39, 266—267; from *Arch. exp. Path. Pharm.*, 1900, 44, 1).—The feebly acid urine is precipitated with mercurous nitrate to which some mercury is added. The filtrate is freed from mercury by hydrogen sulphide, and the latter expelled by warming. It is then treated with silver nitrate and magnesia, which precipitate the allantoin. In this precipitate, after thorough washing, the nitrogen may be estimated by Kjeldahl's process, or the precipitate may be decomposed by hydrogen sulphide and the filtrate evaporated to dryness, the dry residue extracted with hot water, the extract precipitated with mercuric nitrate, and this precipitate treated with hydrogen sulphide. The filtrate from the mercuric sulphide leaves the allantoin on evaporation.

M. J. S.

Estimation of Allantoin in Urine. By R. PODUSCHKA (*Zeit. anal. Chem.*, 1900, 39, 267; from *Arch. exp. Path. Pharm.*, 1900, 44, 59).—The urine (50—100 c.c.) is precipitated with an equal volume of lead acetate solution and filtered. An aliquot part of the filtrate is freed from lead with sodium sulphate; silver nitrate (5—10 per cent. solution) is then added in excess. A measured portion of the filtrate is treated with very dilute ammonia (2 c.c. of a 1 per cent. solution for 50 c.c. of the original urine) and 50—100 c.c. more of silver nitrate. The flocculent precipitate of silver allantoin is thoroughly washed on a suction filter and its nitrogen estimated.

M. J. S.

Detection of Bile Pigments in Urine. By OLOF HAMMARSTEN (*Zeit. anal. Chem.*, 1900, 39, 269—270; from *Skand. Arch. Physiol.*, 9, 313).—A mixture is made of 19 vols. of 25 per cent. hydrochloric acid and 1 vol. of 25 per cent. nitric acid, and allowed to remain for some hours, or until it has become yellowish; then, just before use, one part is mixed with 5 parts of 95—97 per cent. alcohol, and a little of the urine is added. One part of bilirubin in 50,000 parts of urine produces a characteristic green colour. Should other colouring matters be present, 10 c.c. of the urine are mixed with a few c.c. of barium chloride (or, in some cases, calcium chloride, followed by sufficient ammonia to produce neutrality), and the deposit, collected by a centrifugal machine, is treated with 1—2 c.c. of the reagent, and again centrifuged, when the presence of bile will produce a green solution.

M. J. S.

The Volumetric Estimation of Vegetable Alkaloids by Titration with Acids. By CARL KIPPENBERGER (*Zeit. anal. Chem.*, 1900, 39, 202—229; 290—314).—With the object of ascertaining which alkalimetric indicators are most suitable for the titration of alkaloids by standard acid, the author has submitted to titration small quantities (about 0.1 gram, in order that the conditions might be similar to those occurring in chemico-legal investigations) of the most generally occurring alkaloids, using eleven different indicators. The general method consisted in adding an excess of standard sulphuric acid to about 2 grams of the alkaloid, making up to a litre, and titrating the excess of acid in 50 c.c. by *N*/50 sodium hydroxide. With some indicators, the amount of acid consumed was much below the theoretical; with others, above; many of the indicators gave results of approximate accuracy, but the following gave the most satisfactory results: Atropine, morphine, veratrine, codeine, cocaine, nicotine, coniine, papaverine, narcotine with lacmoid; thebaine, codeine, emetine, coniine with iodococin; atropine with uranin (sodium fluorescein); coniine, morphine, thebaine, emetine, brucine, pelletierine with cochineal; aconitine, strychnine, and quinine with azolitmin; sparteine and quinine with hæmatoxylin. Narceine and caffeine could not be titrated with any of the indicators. Methyl- and ethyl-orange gave approximate results only with atropine, emetine, and coniine; phenolphthalein and alkannin could be used for sparteine, but for no other alkaloid, and Congo-red only for coniine. The cases where the consumption of acid falls below the theoretical amount are in general explicable by the fact that in such highly dilute solutions as those employed a considerable proportion of the alkaloid salt, as well as of the indicator, undergoes dissociation, such cases being most conspicuous when the indicator is of a feebly acid character and the alkaloid a weak base; in other cases, it would seem as if a compound of the alkaloid with the indicator were non-existent. With strongly acid indicators and feebly basic alkaloids, the amount of indicator used has considerable influence. Too large a consumption of acid was especially noticeable with the indicators methyl-orange, ethyl-orange, and Congo-red. This phenomenon does not seem to admit of any general explana-

tion ; in some cases, it is clearly due to the formation of a compound of the alkaloid with the acid radicle of the indicator, which is not decomposed by dilute mineral acids, but as a similar effect is sometimes observed with indicators which contain no acid group, the cause remains obscure.

The above methods of titration have been applied to investigate the subject of the extraction of alkaloids from their aqueous solutions by shaking with organic solvents. It was formerly assumed that, with few exceptions, the alkaloids could not be removed by chloroform or ether from strongly acid aqueous solutions, but this is shown to be by no means the case. From a solution strongly acidified with hydrochloric acid, chloroform removes almost the whole of the papaverine and caffeine present, besides smaller amounts of codeine and cocaine in the form of free bases, strychnine, brucine, aconitine, veratrine, narceine, pelletierine, narcotine, and thebaine, in varying amounts, partly as base, and partly as hydrochloride, as well as small quantities of atropine and emetine. Morphine, quinine, nicotine, coniine, sparteine, hyoscyamine, daturine, and scopolamine are not extracted, or only in traces. From sulphuric acid solutions, large proportions of papaverine and caffeine are removed as free bases, and narcotine partly as base and partly as sulphate, whilst quantities varying from 5 per cent. to a trace were extracted of strychnine, brucine, aconitine, veratrine, narceine, emetine, and pelletierine. From solutions saturated with sodium chloride, narcotine and aconitine were wholly removed by chloroform, chiefly as salts, and atropine and quinine partially. Traces of strychnine and brucine could be removed by chloroform from solutions acidified with tartaric acid, and caffeine almost wholly from an oxalic acid solution.

Ether extracts from a hydrochloric acid solution only narcotine and caffeine in weighable amounts, besides traces of aconitine, narceine, and emetine, and from a sulphuric acid solution only caffeine in noteworthy quantity. It does not remove strychnine or brucine from a tartaric acid solution, but extracts much caffeine from one acidified with oxalic acid.

These results support the view that, even in strongly acidified solutions of the alkaloids, a large amount of dissociation into acid and base occurs.

The extraction of morphine, narceine, and strophanthin from alkaline (sodium carbonate) solutions by a mixture of chloroform and alcohol is greatly assisted by saturating the solutions with sodium chloride.

A scheme is given in the paper for the extraction and partial separation of the alkaloids, contained in an aqueous solution, based on the above facts.

M. J. S.

Quantitative Estimation of Alkaloids by means of Standardised Solution of Iodine. By MAX SCHOLTZ (*Arch. Pharm.*, 1900, 238, 301—304).—A controversy with Kippenberger (this vol., ii, 583) on the subject of the value of the iodometric method of titrating alkaloids. The author upholds his previous views.

L. DE K.

Chemico-toxicological Study of Coniine. By DIOSCORIDE VITALI and CESARE STROPPA (*L'Orosi*, 1900, 23, 73—80).—A description is given of the method employed by the authors for the detection of coniine in the contents of the stomach of a victim of hemlock poisoning. Two new reactions of the alkaloid are given: (1) If to a little coniine or one of its salts there be added a few drops of a solution of 1 part of potassium permanganate in 200 of concentrated sulphuric acid and the mixture stirred with a glass rod, the original green colour of the acid permanganate is changed to violet. (2) On evaporating a small quantity of coniine to dryness with a few drops of concentrated nitric acid, the liquid becomes yellowish and leaves an orange-yellow residue having a peculiar aromatic odour. If to this a little potassium hydroxide solution be added, reddish-brown, oily drops separate, a very pronounced odour of hemlock is evolved, and the liquid assumes an orange-red tint. If this be evaporated to dryness, there is obtained a brown, almost black, deposit, soluble in concentrated sulphuric acid to a nearly colourless solution which, when diluted with water and carefully mixed with excess of ammonia, yields a yellow liquid.

T. H. P.

Scheme for the Analysis of Rubber Wares. By OCTAVE CHÉNEAU (*Zeit. Nahr.-Genussm.*, 1900, 3, 312—318).—To ascertain whether the article is of uniform quality, it is generally sufficient to take several samples and determine the sp. gr. and the amount of ash. The latter does not, of course, always represent the true amount of added mineral matter. Many samples contain excess of resinous matters which may be extracted with hot alcohol. The further analysis which may occasionally be considerably shortened is briefly as follows.

The finely divided sample is heated with dilute acetic acid containing a little sugar to decompose any lead dioxide. This treatment removes chalk, white lead, red lead, zinc oxide, alkalis, decomposes any ultramarine, and dissolves potato starch. The extracted mass is washed, dried at 105° and weighed, whilst the dissolved metals are estimated in the acetic acid solution. A portion of the extracted sample is now boiled for a few hours with normal alcoholic soda under a reflux condenser, the alcohol distilled off, and the residue thoroughly washed first with boiling water, then with water acidified with acetic acid, and finally with boiling water; the extraction may be repeated in case of any doubt. After drying at 105° the mass is reweighed, the loss in weight representing "factis," free and "factis"-combined sulphur, natural and added resinous matters, pitch, &c. Inferior, although not adulterated, samples may contain a rather large quantity of matters soluble in sodium hydroxide.

The residue is exhausted with acetone, which dissolves unsaponifiable mineral or rosin oils and asphalt. The acetone is distilled off, the residue dissolved in ether, and after evaporation of the latter, the unsaponifiable matter is dried at 100° and weighed.

The mass left after the treatment with acetone is extracted with cold nitrobenzene, which dissolves unvulcanised rubber and the remaining asphalt. When fully exhausted, the mass is boiled with water to re-

move the adhering nitrobenzene, dried, and weighed. It is then extracted with light petroleum, benzene, or chloroform to remove paraffin and any remaining non-vulcanised rubber. Three grams of the mass are now boiled under a reflux condenser with 3 c.c. of chloroform and 50 c.c. of nitrobenzene for an hour; when cold, 100 c.c. of ether are added, the undissolved matter is collected on a filter, washed with benzene, dried, and weighed. It may contain talc, kaolin, ochre, heavy spar, vermilion, lead sulphide, lead sulphate, and, more rarely, graphite, rasped leather, or cork, vegetable fibres, &c. These are then estimated by the usual methods, the vermilion preferably by the dry process.

The total sulphur is estimated in a separate portion by Henriques' process (this vol., ii, 124). By deducting the amount of sulphur contained in the mineral constituents, the free and organic-combined sulphur is obtained, and by deducting from this the sulphur present in the vulcanised rubber, the free and "factis"-combined sulphur is found. By deducting the sulphur found in the final residue from the sulphur left in the residue from the petroleum extraction, the sulphur in combination with rubber is obtained.

Carbon dioxide is estimated as follows. The finely divided sample, extracted if necessary with hot chloroform and nitrobenzene, is treated with dilute hydrochloric acid. The gas evolved is freed from hydrogen sulphide by passing it over pumice stone moistened with copper sulphate, dried over sulphuric acid, and finally absorbed in a weighed soda-lime tube.

L. DE K.

Chemistry of Tobacco. By RICHARD KISSLING (*Chem. Zeit.*, 1900, 24, 499—500. Compare Abstr., 1898, ii, 659, and 1899, ii, 821).—Seventeen kinds of tobacco were tested and the results recorded. The chief object was to isolate the various resins, some of which are soluble in light petroleum, others in ether, and the remainder in absolute alcohol.

The samples were dried over sulphuric acid, powdered and extracted with light petroleum (b. p. 35—55°) in the apparatus previously described. After evaporating the solvent, the residue was treated with a known weight of potassium hydroxide and distilled in a current of steam to remove nicotine, which was then estimated by the author's process. The alkaline liquid was neutralised with hydrofluosilicic acid, evaporated to dryness, and extracted with boiling absolute alcohol to dissolve resins, and a kind of wax which was quantitatively recovered by cooling to 0°; the resin was then obtained by evaporating the alcohol.

After being extracted with light petroleum, the samples were extracted first with ether and then with absolute alcohol. The extracts so obtained were treated in the same way as the petroleum extract. They contained no wax, but the alcoholic extract contained a large proportion of matters soluble in hot water, which were duly separated from the accompanying resin.

It appears that the nicotine is partly present as a resinate. There is, however, no strict relation between the amounts of nicotine and resins.

L. DE K.

General and Physical Chemistry.

Spectrum of Radium. By CARL RUNGE (*Ann. Phys.*, 1900, [iv], 2, 742—745. Compare Demarçay, this vol., ii, 586).—The author has made a spectroscopic investigation of a radium preparation with stronger dispersion than that employed by Demarçay (this vol., ii, 83). The wave-length determinations of the latter are not regarded as sufficiently exact for the characterisation of the new radium lines. Of the fifteen lines given by Demarçay as characteristic of radium, the author is able to confirm three, λ 4826.14; 4682.346; 3814.591; of the remaining twelve, some are not to be seen, others are probably barium lines. These three radium lines were also detected in a barium bromide preparation. They are not among the lines of the solar spectrum as measured by Rowland. J. C. P.

Electrical Conductivity of Compressed Powders. By FRANZ STREINTZ (*Monatsh.*, 1900, 21, 461—481).—Platinum black, amorphous carbon, and graphite have been investigated, all in the form of compressed cylinders. Special precautions have been taken to secure good and permanent contact of the powder and the electrodes. Compared with the values for solid platinum, the specific resistance of the compressed platinum black (sp. gr. = 11.6) is 6.5 times as great, whilst the temperature coefficient is about half as great. Cylinders of amorphous carbon alter their resistance after their exposure to low temperatures, and are some time in reaching a stable condition, and the specific resistance of this element decreases 1 per cent. for every 1° rise in temperature, facts that point to amorphous carbon being more nearly allied to electrolytic conductors. The compressed cylinders of graphite powder (sp. gr. = 3.0) have a temperature coefficient about twice as great as that of solid graphite, a result probably connected with the difference in density. In respect both of the absolute value of the specific resistance and of the temperature coefficient, graphite is much more nearly allied than amorphous carbon to the metallic conductors. J. C. P.

Gaseous Polarisation in the Lead Accumulator. By WALTHER NEERNST and F. DOLEZALEK (*Zeit. Elektrochem.*, 1900, 6, 549—550).—When dilute sulphuric acid is electrolysed with platinum electrodes, the evolution of hydrogen and oxygen begins at an E.M.F. of about 1.7 volts, whereas in an accumulator (where the acid is electrolysed with lead electrodes) no gas is evolved at an E.M.F. of about 2 volts, the products formed being lead and lead peroxide until all the available lead sulphate has been decomposed, after which hydrogen and oxygen begin to be evolved at an E.M.F. of about 2.3 volts. This discrepancy is explained by the recent experiments of Caspari (this vol., ii, 7), which show that the minimum E.M.F. required for the liberation of hydrogen depends on the nature of the metal of which the electrode is made, metals which occlude hydrogen most readily requiring the smallest E.M.F. The accuracy of this explanation is confirmed by the following experiment. A platinum and a leaden dish of equal size were filled with solid lead sulphate and dilute

sulphuric acid. Into the acid in each a plate of lead peroxide dipped. The same small current was passed through both cells, the dishes forming the cathodes. In the platinum, dish the E.M.F. between anode and cathode was 1.6 volts, in the leaden dish it was 1.92 volts, and after three weeks the lead sulphate in the platinum dish was found to be unaltered, whereas that in the leaden dish was almost wholly reduced to lead. T. E.

Gaseous Polarisation in the Lead Accumulator. By STRASSER and GAHL (*Zeit. Elektrochem.*, 1900, 7, 11).—The E.M.F. required to charge an accumulator depends, other things being the same, on whether the grating of the negative plate is made of hard or of soft lead. The authors find that this is due to the fact that a smaller E.M.F. is required to liberate gaseous hydrogen on a surface of antimony than on one of pure lead, the alloys of the two metals occupying intermediate positions. The E.M.F. also depends on the surface; it is smaller for spongy metal than for a smooth surface. The E.M.F. of the accumulator is not affected by the addition of antimony to the negative plate. The phenomenon is, therefore, another example of the influence of the nature of the metal forming the cathode on the E.M.F. required to liberate gaseous hydrogen on its surface (compare preceding abstract). T. E.

Potentials of Copper Electrodes in Solutions. Copper Precipitates of importance in Analysis. By CL. IMMERWAHR (*Zeit. anorg. Chem.*, 1900, 24, 269—278).—The author insists on the importance of knowing the solubility of the precipitates so often met with in analytical work, and by determination of a number of potentials calculates the copper ion concentrations in saturated solutions of these precipitates. The potentials of copper electrodes in contact with the complex ammonia and potassium cyanide solutions alter gradually, showing that the concentration of the copper ions changes. In the case of the cuprous salts, only the relative ionic concentrations could be determined. J. C. P.

Oxidation Potentials. By F. CROTOGINO (*Zeit. anorg. Chem.*, 1900, 24, 225—262).—Oxidising agents are divided into two classes; (1) those which give up oxygen; (2) those which take on or give up ionic charges. One of the most important influencing factors in the case of the second class is the acid concentration. It is shown on the lines of Jannasch and Ashoff's work (*Abstr.*, 1893, ii, 295), that by regulation of the acid concentration, a complete separation of combined iodine, bromine, and chlorine can be effected. An electro-metric method of estimating an iodide is described. A platinum electrode is immersed in the solution to be titrated and the system is connected with a normal electrode. As standard potassium permanganate is gradually added to the iodide, the potential at the platinum electrode slowly alters until all the iodine is liberated, at which point a sudden change in the value of the potential is observed (compare Behrend, *Abstr.*, 1893, ii, 387). An attempt was made to measure a number of oxidation potentials on the lines of Bancroft's work (*Abstr.*, 1893, ii, 58), but constant values could be obtained only in cases where the concentration of the hydrogen ions remains

unchanged during the action—in particular for iodine. A platinum electrode immersed in potassium iodide solutions of different strengths, but always saturated with iodine, showed a potential π in agreement with the formula: $\log. K = \pi/0.0259 + \log. (I')^2/(I_2)$, where K is a constant, (I') the concentration of the iodine ions, and (I_2) that of the free iodine. The results were found to be independent of the acid concentration. When different quantities of iodine are dissolved in potassium iodide of given concentration, a form of concentration cell can be set up, and the application of Nernst's formula in this case shows that when the concentration of free iodine is very small, the E.M.F. of the cell should approach a limiting value; this is borne out by the experiments made.

The E.M.F. of an oxygen-air cell exhibits great variations: the maximum value obtained agrees well with that of Smale (Abstr., 1894, ii, 436), but it is seven times the theoretical value. J. C. P.

The Discharge Potential of Chlorine Ions. By ERICH MÜLLER (*Zeit. Elektrochem.*, 1900, 6, 573—578, 581—583).—The discharge potential of chlorine ions in normal hydrochloric acid, against a normal hydrogen electrode, has been measured as 1.31 volts; this is also the E.M.F. of the hydrogen-chlorine gas cell. The author discusses the reasons for believing that hydrochloric acid acts as a depolariser for chlorine, and that the E.M.F. of 1.31 volts really indicates the beginning of a chemical reaction between the chlorine and the solution, and does not correspond with the liberation of free chlorine. His measurements show that in a normal solution of hydrochloric acid or of common salt, some other change begins at the anode when the P.D. between it and the solution is 2.2 volts (or about 1.9 volts measured against a normal hydrogen electrode).

Whether this change is the liberation of free chlorine is undecided, but the author considers that it is the one on which the electrolytic formation of chlorates mainly depends. T. E.

Migration Constant of Sulphuric Acid. By ARTHUR KENDRICK (*Zeit. Elektrochem.*, 1900, 7, 52).—Thermodynamics shows that the E.M.F. of a concentration cell depends (among other things) on the migration constant of the electrolyte. The author has measured the E.M.F.'s of concentration cells containing (a) hydrogen electrodes, (b) lead electrodes, and (c) lead peroxide electrodes in sulphuric acid of different concentrations. By means of these measurements and the equations mentioned, he calculates the values of n for hydrogen in sulphuric acid of various strengths. The results agree with the numbers obtained by other observers by measuring the changes of concentration at the electrodes (Hittorf's method) about as well as these numbers agree with each other. T. E.

Apparatus for Illustrating the Migration and Separation of Ions. By ERICH MÜLLER (*Zeit. Elektrochem.*, 1900, 6, 589—591).—The apparatus is designed for lecture illustration, to show the separation of equivalent quantities of the ions at the electrodes, and also the accompanying changes of concentration due to their different velocities. Blocks of wood suitably marked to represent the ions

slide horizontally past each other on wooden bars at different velocities. The different velocities are obtained by strings attached to pulleys of different size. When the blocks reach the ends of the bars they fall off in order to represent the separation of the ions from the solution. For details of construction, the figures in the original must be consulted.

T. E.

Electro-synthesis of Organic Substances. By OCTAVE DONY-HÉNAULT (*Zeit. Elektrochem.*, 1900, 6, 533—543).—Reactions between non-dissociated substances and discharged ions are considered. In order that an ion shall part with its electrical charge, a certain difference of potential (the discharge potential) must exist between the electrode and the electrolyte. When the solution contains a substance capable of reacting with the discharged ion (a depolariser), the discharge potential is diminished. The discharge potential is measured by the method of Bose (*Abstr.*, 1899, ii, 348). Ethyl alcohol, acetic acid, acetone, acetaldehyde, quinol, and especially phenol, act as depolarisers for Cl and Br. Bromophenols may be prepared by the electrolysis of a solution of hydrobromic acid and phenol in acetic acid.

The oxidation of methyl and ethyl alcohols is studied more fully. The discharge potential of OH ions from 0.9 normal sulphuric acid, for example, is diminished by about 0.5 volt by the addition of about 20 per cent. of ethyl alcohol, whilst an equal quantity of acetaldehyde has practically no effect. Ethyl alcohol is therefore more readily oxidised than acetaldehyde, and by using a sufficiently small E.M.F. it should be possible to oxidise alcohol to acetaldehyde quantitatively. This is shown to be the case. With higher E.M.F.'s, and a correspondingly higher current density, ethyl hydrogen sulphate is also formed.

Formaldehyde was not obtained from methyl alcohol.

The order of activity of chemical oxidising agents is given by the E.M.F. which they develop in a so-called oxidation cell. By the use of an oxidising agent, giving a sufficiently low E.M.F., it should therefore be possible to attain the same results as those given by electrolytic oxidation. It is shown, in fact, that acetaldehyde is the only product of the oxidation of ethyl alcohol, in faintly alkaline solution, by lead dioxide or cupric oxide.

T. E.

Electrolysis of Fused Salts. By FRIEDRICH QUINCKE (*Zeit. anorg. Chem.*, 1900, 24, 220—221).—The author previously (compare *Abstr.*, 1889, 458) regarded the deviations from Faraday's law, observed in the electrolysis of fused salts, as due to an insufficiently high internal resistance, and he sees a confirmation of this view in the recent work of Lorenz and Helfenstein (this vol., ii, 333 and 383). He supposes that, in the case of fused salts, a conductor of the second order may be converted into one of the first order, and points out that Lorenz and Helfenstein should have taken account of thermocurrents.

J. C. P.

Electrolysis of Fused Salts. By RICHARD LORENZ (*Zeit. anorg. Chem.*, 1900, 24, 222—224).—The author criticises the views of Quincke (preceding abstract), and considers that the work of Lorenz and Helfenstein renders them untenable.

J. C. P.

Evolution of Oxygen at the Anode in the Electrolysis of Solutions of Alkali Chlorides. By FRITZ FOERSTER and H. SONNEBORN (*Zeit. Elektrochem.*, 1900, 6, 598—604).—Neutral solutions of potassium chloride were electrolysed in such a way that the concentration at the anode remained practically constant, and that not a trace of the potassium hydroxide formed at the cathode could get into the anode solution. The concentrations of the solutions varied from 0.3 to 3.16 normal. Oxygen was evolved in all cases, and hydrogen chloride formed at the anode. Traces of chlorate were probably formed in the more dilute solutions. The quantity of hydrogen chloride formed corresponded with the quantity of oxygen liberated. This quantity decreased as the concentration of the solutions increased, 6.3 per cent. of the current producing oxygen from the most dilute solution and only 0.09 per cent. from the most concentrated. These results are very similar to those obtained with hydrochloric acid. The authors conclude that, in the electrolysis of neutral solutions of alkali chlorides, the anions of water are discharged to some extent at the anode, but that, in not too dilute solutions, the formation of chlorate and the simultaneous evolution of oxygen are almost exclusively due to the hypochlorite which is first formed by the electrolysis. T. E.

Conductivity Temperature Coefficient of some Liquid Ammonia Solutions. By EDWARD C. FRANKLIN and CHARLES A. KRAUS (*Amer. Chem. J.*, 1900, 24, 83—93).—Arrhenius (Abstr., 1889, 1044) has shown that the conductivity of solutions at first increases with rising temperature, reaching a maximum value; in the case of aqueous solutions, however, the temperatures of maximum molecular conductivity generally lie too high for experimental verification. The authors, in a preliminary investigation, find that solutions of several electrolytes in liquid ammonia pass through well-marked maxima of conductivity with rising temperature. Solutions in liquid ammonia retain the power of carrying the electric current up to and beyond the critical temperature of the solution. When potassium, sodium, and lithium are dissolved in liquid ammonia, the solutions have positive temperature coefficients of conductivity. Methylamine is found to be an electrolytic solvent. J. C. P.

Propagation of Condensation Waves in Heated Gases. By HENRI LE CHATELIER (*Compt. rend.*, 1900, 131, 30—35).—The velocity of high condensation waves in gases at the ordinary temperature has been shown to be considerably greater than that of sound, a result in accord with theory. The author's experiments show that this is also the case at high temperatures, and a noticeable point is the great decrease of velocity occasioned by reflection either from the walls or from an opposing condensation wave. Thus, in a mixture of acetylene and oxygen, the velocity of 2300 was after the first reflection reduced to 1350, after crossing an opposed wave, to 1080, and after a second crossing to 980. It is also shown that, after the passage of the wave, the whole mass of gas remains in an oscillatory state. L. M. J.

Apparatus for Melting Point Determinations. By JOSEPH HOUBEN (*Chem. Zeit.*, 1900, 24, 538).—The apparatus recommended

resembles that described by Roth (Abstr., 1886, 1070), except that the bulb and inner tube are not fused together, but are ground into one another; both are provided with perforations in their necks, which are so arranged that the sulphuric acid which they contain may be in direct communication with the atmosphere or by simply turning the inner tube may be completely shut off.

J. J. S.

Liquefaction of Gaseous Mixtures. By F. CAUBET (*Compt. rend.*, 1900, 131, 108—109).—The previous work (this vol., ii, 191, 390) is extended to mixtures of methyl chloride and sulphur dioxide, and the vapour pressure curves for the mixtures are given. This case differs from those previously investigated on account of the proximity of the curves of the two constituents. Retrograde condensation was not observed, but an interesting feature is the experimental verification of the points named by Duhem the points of Gibbs and Konowaloff.

L. M. J.

Dissociation in Colloidal Solutions. By M. G. LEVI (*Gazzetta*, 1900, 30, ii, 64—70).—Potassium iodide is dissociated to the same degree in solutions of gelatin, agar-agar, or silicic acid, as in aqueous solution. The lowering of the freezing point by potassium iodide and chloride, and the velocity of inversion of sugar by hydrochloric acid, have the same values in pure water as in colloidal solutions.

T. H. P.

Relation of the Taste of Acid Salts to their Degree of Dissociation. II. By LOUIS KAHLENBERG (*J. Physical Chem.*, 1900, 4, 533—537).—A reply to Richards (this vol., 391), in which the author contends that the former only explains why the taste for low hydrogen concentrations is more marked than would be expected, but does not give any explanation of the fact that a solution of an acid salt possesses a sour taste when the hydrogen ion concentration is far lower than that at which the sour taste disappears in solutions of acids, as for example, hydrogen chloride. Hence he still considers the explanation of the taste on the dissociation hypothesis to be unsatisfactory.

L. M. J.

Solubility of a Mixture of Salts having one Common Ion. By CHARLES TOUREN (*Compt. rend.*, 1900, 131, 259—261).—An extension of the previous work (this vol., ii, 396, 530) to mixtures of potassium nitrate and carbonate. As the latter contains two potassium ions, the concentration must be doubled in constructing the curve, and it is found that only for very low concentrations of the carbonate does the curve coincide with that for mixtures of nitrate and chloride, falling below the latter very soon, and hence indicating incomplete dissociation or the formation of KCO_3 ions even at low concentrations. Mixtures of potassium nitrate and bicarbonate were also examined, but the case is complicated owing to the fact that carbon dioxide increases the solubility of the nitrate.

L. M. J.

Law of Corresponding States. By DANIEL BERTHELOT (*Compt. rend.*, 1900, 131, 175—178).—The author has previously indicated a method for the calculation of the minimum volumes of compounds,

and stated that if volumes be measured from these minima and different temperature zeros employed, the law of corresponding states is valid (this vol., ii, 335). The values of these zeros and minima are given for a number of compounds, and it is shown that these lead to results in very close accord with those deduced empirically by Madame Meyer (this vol., ii, 263).

L. M. J.

Development and Propagation of an Explosive Wave. By HENRI LE CHATELIER (*Compt. rend.*, 1900, 130, 1755—1758).—The velocity of propagation of explosive waves was measured by a photographic method; in the case of mixtures of acetylene and oxygen, the velocity of propagation of the flame is at first very great (many hundreds of metres per second), and is succeeded by the explosive wave which is characterised by a still greater and uniform velocity. The initial phenomena differ in different gases, the velocity being usually much smaller, occasionally only a few metres per second. For acetylene and oxygen, the velocity of the explosion reached a maximum of 2920 metres per sec. for the mixture $C_2H_2 + O_2$, and fell to 1850 metres for the mixture $C_2H_2 + 10O_2$, which is the limiting composition for the propagation of the wave. Other mixtures were examined, and in the case of mixtures of carbon monoxide and oxygen, it was found that when the charge of fulminate, used to induce the explosion, is great, the explosive wave does not pass, owing to its velocity being smaller than that of the compression wave produced by the fulminate.

L. M. J.

Energy of some Metallic Hydroxides deduced from the Hydrolysis of their Salts. By GIACOMO CARRARA and G. B. VESPIGNANI (*Gazzetta*, 30, ii, 35—63).—A number of measurements have been made of the electrical conductivity of, and the velocity of hydrolysis of methyl acetate by, various neutral and basic salts of iron, aluminium, &c. The results show that: (1) The basic energy of hydroxides of the metals is in accord with their position in the periodic system, decreasing, for instance, in the series Mg, Cu, Zn, Cd, Al, Fe; the assumption that ferric hydroxide is a more energetic base than aluminium hydroxide is hence erroneous. (2) Basic ferric chloride in aqueous solution is hydrolysed to a considerable extent, the basic sulphate less so, and basic aluminium sulphate much less still. (3) Even in presence of a large excess of potassium hydroxide, aluminium hydroxide forms only a potassium mono-aluminate. (4) Aluminium hydroxide acts more energetically as a base than as an acid, the degree of hydrolysis of the aluminates being fourteen times that of aluminium sulphate. (5) When dissolved in excess of not too concentrated potassium hydroxide, the oxides of lead and zinc yield respectively monopotassium plumbate and dipotassium zincate.

T. H. P.

Chemical Dynamics. Dynamical Observations on the Bromination of Benzene. By LOUIS BRUNER (*Chem. Centr.*, 1900, ii, 257—258; from *Bull. Acad. Sci. Cracow*, 1900, Januar).—In order to determine the rate of formation of bromobenzene, a bulb containing bromine was broken in the calculated quantity of benzene and the tube then sealed. After a definite time, the contents of the tube were

mixed with concentrated potassium iodide solution, and the bromine used estimated by titrating the liberated iodine. The results showed that the bromination of benzene does not stop at a limit of 50 per cent., but with a continually decreasing velocity approaches the theoretical limit. After 150 days, 94.1 per cent. was found to have been brominated. The velocity is dependent only on the concentration of the bromine, and bromobenzene has no catalytic effect on the action. The velocity is increased, however, by the presence of moisture. Experiments in which an excess of benzene was used showed that the velocity constant approached only a constant mean when calculated for a bimolecular reaction. The addition of a quantity of iodine, amounting to 1 per cent. of the benzene, increased the velocity constant ten times, whilst 2 per cent. of iodine raised its value fortyfold. By the action of 60 grams of bromine on 3 equivalents of benzene containing 2 per cent. of iodine for 7 days, a yield of 85 per cent. of bromobenzene was obtained.

E. W. W.

Velocity of the Formation of Esters from Benzoyl Chloride and Aliphatic Alcohols. By LOUIS BRUNER and STANISLAW TOLLOZKO (*Chem. Centr.*, 1900, ii, 257; from *Bull. Acad. Sci. Cracow*, 1899, 475—487).—The velocity of the formation of esters by the action of benzoyl chloride on methyl, ethyl, propyl, isobutyl, isoamyl, and isocapryl alcohols has been determined. A sufficiently large excess of the alcohol was used for the unimolecular reaction $\text{Ph}\cdot\text{COCl} + \text{ROH} = \text{Ph}\cdot\text{CO}_2\text{R} + \text{HCl}$ according to the formula $K = (1/A)(\log. A/A - x)$, and the constants K were determined. The results are tabulated in the original paper. The velocity constants were found to decrease rapidly as the molecular weight of the alcohol increased. Since they were found to become less as the time of the reaction was prolonged, other secondary actions must also take place.

E. W. W.

Lecture Experiments for Demonstrating Fractional Distillation. By P. N. RAIKOW (*Chem. Zeit.*, 1900, 24, 645—646).—The principles of fractional distillation may be readily demonstrated to a large audience by employing liquids which burn with different flames, for example, formic acid and ethyl benzoate. The flame is first a clear blue, then gradually assumes a yellow tinge, and finally becomes perfectly luminous.

J. J. S.

System of Indexing Chemical Literature; Adopted by the Classification Division of the U.S. Patent Office. By EDWIN A. HILL (*J. Amer. Chem. Soc.*, 1900, 22, 478—494).—A discussion of a system of indexing based upon the empirical formulæ of the chemical substances.

E. G.

Inorganic Chemistry.

Some Properties of Liquid Chlorine. By A. LANGE (*Zeit. angew. Chem.*, 1900, 683—686).—The specific gravity of liquid chlorine has been determined for temperatures between -50° and $+100^{\circ}$ by the method previously employed in the case of liquid ammonia and sulphur dioxide (see Abstr., 1899, ii, 478). The results obtained agree well with those of Knietzsch (Abstr., 1891, 14). The coefficient of expansion of liquid chlorine increases slowly but regularly, and at 90° is as great as the coefficient of gaseous expansion. The coefficient of compressibility increases from 0.000225 at 37° to 0.000637 at 93° . Liquid chlorine does not attack the iron of the containing vessel, except above 90° . The author discusses also the conditions for the safe transport of liquid chlorine. J. C. P.

Extraction of Oxygen from Air by Dissolution at a Low Temperature. By GEORGES CLAUDE (*Compt. rend.*, 1900, 131, 447—450).—The author has examined the solubility of oxygen and nitrogen at low temperatures in alcohols, ethers, acetone, chloroform, petroleum, benzene, and various inorganic liquids with a view to obtain partial separation of the oxygen and nitrogen of the air. At low temperatures, the solubility of the nitrogen increases at the same rate as that of the oxygen, and hence the method seems to be of no value for practical purposes. C. H. B.

Composition of the Air at Various Altitudes. By GUSTAVUS HINRICHS (*Compt. rend.*, 1900, 131, 442—443).—Assuming that each of the components of the atmosphere forms an atmosphere independent of the other gases, and that the pressure p of each of them at the altitude H in myriametres is given by Laplace's formula, $\log. P/p = H/K$, and that for a gas of density D the constant K has the value $1.8400/D$, and further, that there is no reciprocal action, the percentage composition of the air by volume at various altitudes will be as follows:

Altitude in myriametres.	Carbon dioxide.	Oxygen.	Argon.	Nitrogen.	Hydrogen.
0	0.3	21.00	1.20	77.75	0.02
1	0.2	18.43	0.75	80.74	0.06
2	0.1	16.07	0.46	83.26	0.20
3	0.00	13.90	0.28	85.18	0.64
4	—	11.86	0.16	85.94	2.04
5	—	9.83	0.12	83.94	6.11
6	—	7.52	0.00	75.54	16.94
7	—	4.7	—	56.2	39.10
8	—	2.2	—	31.0	66.8
9	—	0.7	—	12.9	86.4
10	—	0.3	—	4.6	95.1

It is noteworthy that the proportion of nitrogen passes through a maximum at an altitude of 4 myriametres, whilst at an altitude of 10 myriametres the atmosphere will be almost pure hydrogen.

C. H. B.

Action of Iodides and Hydriodic Acid on Sulphur Dioxide. By JAKOB VOLHARD (*Bull. Soc. Chim.*, 1900, [iii], 23, 673—674).—Referring to the recent experiments of Berg (this vol., ii, 535), it is pointed out that the action of hydriodic acid on sulphur dioxide was studied by the author in 1887 (*Abstr.*, 1889, 192). The existence of an unstable compound of hydrogen iodide and sulphur dioxide, as suggested by Berg, is considered to be improbable, and the decomposition is attributed to the simultaneous occurrence of two reactions, namely, the oxidation of the hydrogen iodide by the sulphur dioxide with the formation of iodine and sulphur, and the oxidation of the sulphur dioxide by the iodine with the further deposition of sulphur and regeneration of hydrogen iodide. N. L.

Relationship between Reactivity and Concentration of Sulphuric Acid. By WILHELM VAUBEL (*J. pr. Chem.*, 1900, [ii], 62, 141—144).—A number of the reactions of sulphuric acid depend on the hydrates that are present in the solution, rather than on the degree of electrolytic dissociation. Amongst these are the green coloration with phenylrosinduline at concentrations below 95.2 per cent., the formation of hydrogen sulphide from sodium thiosulphate at concentrations above 84.1 per cent., and the series of colours produced at different concentrations in safranin solutions. T. M. L.

Allotropic Forms of Selenium. By A. P. SAUNDERS (*J. Physical Chem.*, 1900, 4, 423—513).—Besides the author's own investigations, the paper contains an extensive *résumé* of all previous work on selenium, its physical properties and behaviour. The author considers that there are only three modifications of selenium, namely, (1) the liquid, including what are known as the vitreous, amorphous, and soluble varieties; (2) the red crystalline, and (3) the black crystalline or metallic modification. Of these, the metallic form is the most stable, the red crystalline being intermediate between the other two, with probably its potential curve cutting that of the liquid variety below the point of intersection of the other two curves, that is, below 217°, the melting point of metallic selenium. Although this view explains most of the previous observations, a few are still inexplicable. The vitreous form changes to the metallic form on heating, the velocity rapidly increasing above 60°, but there is no transition point, the metallic variety being stable at all temperatures. In no case does a change to the red crystalline form take place, except in the presence of certain solvents. Although the vitreous and amorphous varieties are regarded as identical, there are slight differences in properties which must be ascribed to differences of aggregation. In the presence of various organic liquids, amorphous selenium is converted more or less speedily into one of the other forms, and the action of a large number of liquids was studied. It is noticeable that those causing change to the metallic form are generally nitrogenous compounds, especially ring compounds, with nuclear nitrogen. The red crystals have an unstable melting point below 217°. The values for the heat of transformation obtained by various observers differ greatly; it is, however, certainly sufficient to raise the mass to the melting point, and probably considerably greater than this. Specific heat and density observations are collected, and the

author's results added. The most probable density values are ; amorphous 4.26, vitreous 4.28, red crystals 4.47, metallic 4.80. The action of light on the conductivity is discussed, and the values for the various physical constants are collected.

L. M. J.

Electrolysis of Azoimide. By ALBERTO PERATONER and GIUSEPPE ODDO (*Gazzetta*, 1900, 30, ii, 95—96).—Referring to Szarvasy's work (*Trans.*, 1900, 77, 606) on this subject, the authors call attention to the paper published by them in 1895 (*Abstr.*, 1896, ii, 245), in which they show that the deviation of the ratio of the volumes of nitrogen and hydrogen from the theoretical value is due to secondary reactions occurring during the electrolysis.

T. H. P.

Production of Nitric Acid from Air by Means of the Electric Flame. By ARTHUR McDUGALL and FRED HOWLES (*Mem. Manchester Lit. and Phil. Soc.*, 1900, 44, Pt. iv, No. 13, 1—19).—The amount of nitric acid produced by means of the electric flame depends very largely on the form of the combustion chamber ; when using about 225 watts, a large horizontal stoneware pipe gave only 98 grams per 12 H.P.-hours, whilst a vertical stoneware bottle gave 180 grams, and a second vertical chamber of conical shape gave 270 grams. The yield is greatest when the current is only just sufficient to keep the flame steady, and rose from 270 to 300 grams per 12 H.P.-hours when 172 watts were used instead of 225, but fell to 180 grams when 302 watts were used. By using instead of air a mixture of 2 vols. oxygen to 1 vol. nitrogen, the yield was raised to 590 grams, whereas Lord Rayleigh obtained 440 grams in his apparatus. The yield is decreased when the air supply is heated, and, owing to the excessive heating, is very small when a low-tension discharge between carbon poles is used.

T. M. L.

[Alleged] Conversion of Phosphorus into Arsenic and into Antimony. By FRIEDRICH FITTICA (*Chem. Zeit.*, 1900, 24, 561—562).—A reply to Winkler (this vol., ii, 476). The author considers that Winkler's failures in obtaining even minute traces of arsenic are due to the fact that the directions previously given were not accurately followed. He further states that antimony is a nitrogen derivative of phosphorus, and may be obtained in small quantities, together with arsenic, by heating amorphous phosphorus with ammonium nitrate and potassium nitrite, with or without the addition of ammonium carbonate.

J. J. S.

Metaphosphates. By GEORG VON KNORRE (*Zeit. anorg. Chem.*, 1900, 24, 369—401).—The author has reinvestigated the metaphosphates, and gives an account of the work done by other authors. Sodium trimetaphosphate, when prepared according to the methods of Fleitmann and Henneburg (*Annalen*, 1848, 65, 304, and *Ann. Phys. Chem.*, 1849, 78, 233, 238, 361), or of Lindboom (*Ber.*, 1875, 8, 122), contain small quantities of sodium hydrogen pyrophosphate and hexametaphosphate, which cannot be eliminated by fractional crystallisation. A pure salt, however, can be prepared by treating the solution with excess of a solution of lead nitrate, whereby the lead salts of the admixed phosphates are precipitated, and the pure lead trimetaphos-

phate is then decomposed with sodium sulphate. Sodium trimetaphosphate is also easily obtained in a pure state by heating sodium orthophosphate with ammonium nitrate for 6 hours at 300°. The electrical conductivity of the solutions of the salt is in accordance with the presence of a tribasic acid.

When sodium ammonium phosphate is heated, the following products are obtained: at 200°, sodium hydrogen pyrophosphate; at 280°, insoluble metaphosphate, soluble metaphosphate, and pyrophosphate; at 310°, insoluble sodium metaphosphate, together with some trimetaphosphate and pyrophosphate. Sodium dihydrogen phosphate, when heated at 210° to 240°, is converted into pyrophosphate; at 280°, it is converted into insoluble metaphosphate, pyrophosphate, and trimetaphosphate. Diammonium hydrogen phosphate yields the following salts: when heated at 155°, ammonium dihydrogen phosphate; at 166°, pyrophosphate begins to be formed; at 216°, 280°, and 360°, mixtures of phosphate, trimetaphosphate, and pyrophosphate are obtained, but an insoluble ammonium metaphosphate is not formed.

Insoluble sodium metaphosphate is obtained in almost theoretical quantities by evaporating a solution of sodium nitrate with not more than 10 per cent. excess of phosphoric acid, and then heating the residue at 330°. The three modifications of insoluble sodium metaphosphate described by Tammann (Abstr., 1892, 1050) are, according to the author, identical.

E. C. R.

Action of Hydrogen on the Sulphides of Arsenic. By H. PÉLABON (*Compt. rend.*, 1900, 131, 416—419).—The interaction of realgar with hydrogen at temperatures above 300° is reversible, $2\text{H}_2 + \text{As}_2\text{S}_3 \rightleftharpoons 2\text{H}_2\text{S} + \text{As}_2$. Experiments at 610°, in tubes containing 0.5 gram of realgar and about 8 c.c. of hydrogen measured under atmospheric pressure, show a limit of the action, when R , the ratio of the partial pressure of hydrogen sulphide to the total pressure in the tube on cooling, has a value 93.07. If more than 0.3 gram of realgar is used (that is, so that some remains unvolatilised at 610°), increasing the amount of arsenic gradually diminishes the value of R until a constant value 78.69 is reached. The action of hydrogen sulphide on arsenic at 610° has a limit characterised by $R = 64.90$. All these results are shown to be in accord with the theory of dissociation.

W. A. D.

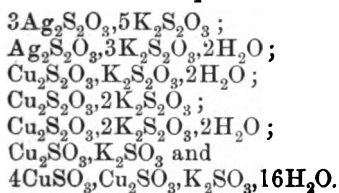
Permeability of Molten Silica to Hydrogen. By P. VILLARD (*Compt. rend.*, 1900, 130, 1752—1753).—If a tube of silica attached to a manometer is exhausted and then heated by a Bunsen flame, the pressure inside rises, and it was shown that this is due to the passage of hydrogen through the walls of the tube. The permeability increases considerably when the temperature is raised sufficiently to soften the silica.

L. M. J.

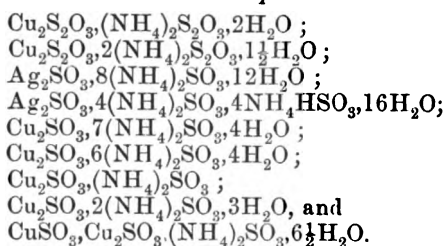
Double Thiosulphates and Sulphites of the Alkali Metals, Silver, and Copper. By ARTHUR ROSENHEIM and SIEGFRIED STEINHÄUSER (*Zeit. anorg. Chem.*, 1900, 25, 72—103).—A large number of the numerous double compounds of the alkali thiosulphates and sulphites with silver and cuprous thiosulphates and sulphites respec-

tively, which have been described, are evidently mixtures, and of those which may be considered as chemical compounds it is not possible to determine if they are double salts or complex compounds, since most of them are very sparingly soluble and are readily decomposed in solution. The potassium and ammonium compounds have the simpler composition, and are probably double salts; the sodium compounds are mostly of a very complicated composition, and the authors consider these to be examples of the solid-solution of cuprous and silver thiosulphates and sulphites. The following are described :

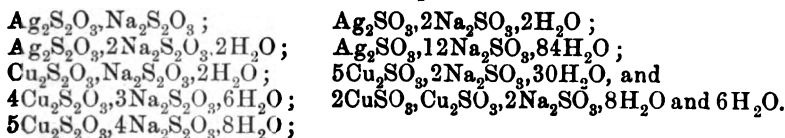
Potassium compounds :



Ammonium compounds :



Sodium compounds :



E. C. R.

Double Salts of Ammonium Thiosulphate with Silver and Copper Haloids. By ARTHUR ROSENHEIM and SIEGFRIED STEINHAÜSER (*Zeit. anorg. Chem.*, 1900, 25, 103—111).—Silver chloride, when dissolved in sodium or potassium thiosulphate, undergoes double decomposition with the formation of double compounds of silver thiosulphate and alkali thiosulphate; it dissolves, however, in ammonium thiosulphate with the formation of compounds containing chlorine.

The *salt*, $\text{AgCl}, \text{NH}_4\text{Cl}, 4(\text{NH}_4)_2\text{S}_2\text{O}_3$, obtained by saturating a solution of ammonium thiosulphate with silver chloride and concentrating in a vacuum over sulphuric acid, crystallises in lustrous, quadratic crystals [$a : c = 1 : 0.635596$], is extremely stable, can be dissolved without decomposition in cold water or ammonia, yields a small quantity of silver sulphide when boiled with water, is decomposed by dilute acids into silver chloride, silver sulphide, sulphur, hydrogen sulphide, and sulphur dioxide, and by alkaline hydroxides with formation of silver oxide and evolution of ammonia. The corresponding *bromine* compound, $\text{AgBr}, \text{NH}_4\text{Br}, 4(\text{NH}_4)_2\text{S}_2\text{O}_3$, is isomorphous with the preceding [$a : c = 1 : 0.62948$]. The corresponding *iodine* and the *thiocyanogen* compounds are also described. With silver cyanide and ammonium thiosulphate, beautiful, lustrous crystals are obtained, of which, however, the various preparations differ considerably in composition, although they are identical in appearance.

Cuprous chloride yields a similar compound to silver chloride. The *chlorine* compound, $\text{CuCl} \cdot \text{NH}_4\text{Cl} \cdot 4(\text{NH}_4)_2\text{S}_2\text{O}_8$ [$\alpha : c = 1 : 0.631327$], and the *bromine* compound [$\alpha : c = 1 : 0.63828$] are isomorphous with the corresponding silver compounds. The *iodine* and *thiocyanogen* compounds, and the crystals obtained from copper cyanide are similar to the silver compounds.

Apparently, only the haloid salts of the members of the first group of the periodic system are capable of forming these complex compounds, which are similar to the double salts of potassium iodide and ethyl sulphonates of the formula $\text{R}'\text{I} \cdot 4\text{EtSO}_3\text{R}'$. E. C. R.

Composition of Bottle Glasses. By KARL ZULKOWSKI (*Chem. Zeit.*, 1900, 24, 439—440).—A reply to the criticisms of Dralle (this vol., ii, 482) on the author's previous communications (*Chem. Ind.*, 1899, 22, 280; and 1900, 23, 108). E. G.

Atomic Weight of Radio-active Barium. By SKŁODOWSKA CURIE (*Compt. rend.*, 1900, 131, 382—384).—By fractionally crystallising radio-active barium chloride (this vol., ii, 81—83, 126, 254), the authoress has isolated about 2 centigrams of a substance free from barium, which she considers to be nearly pure radium chloride. Insufficient substance was obtained to determine the atomic weight of the metal, but a sample of radio-active barium chloride, which appeared from its spectrum to contain rather more radium than barium (Demarçay), gave a value 173.9 for the atomic weight of radio-active barium; the atomic weight of radium is thus much greater than 174.

It is noteworthy that radio-active barium chloride rich in radium, after being kept several days, especially in a moist atmosphere, changes in colour and appearance and evolves an odour resembling that of potassium hypochlorite; simultaneously, the radio-activity increases. W. A. D.

Boiling Points of Zinc and Cadmium. By DANIEL BERTHELOT (*Compt. rend.*, 1900, 131, 380—382).—The boiling points were determined in an atmosphere of nitrogen by means of a thermoelectric couple of platinum and platinum-iridium, special care being taken to prevent loss of heat by cooling. Carefully purified zinc boils at 920° under 760 mm. pressure; the relationship of this result to that of other observers is discussed. Pure cadmium boils at 778° under normal pressure; the values of other observers are far from concordant, Becquerel giving 746° , Carnelley 763 — 772° , and Deville and Troost 815° . W. A. D.

Trihydrated Acid Cadmium Iodide. By D. DOBROSERDOFF (*J. Russ. Phys. Chem. Soc.*, 1900, 32, 297—300).—On passing hydrogen iodide into a pasty mass of powdered cadmium iodide mixed with a saturated solution of the salt, a large quantity of the gas is absorbed, and when all the solid is dissolved and absorption of hydrogen iodide ceases, there remains a dark brown, almost black, liquid which fumes strongly in the air and has a sp. gr. about 3. At -4.7° , this liquid

slowly solidifies to a mass of almost colourless needles of the composition $\text{CdI}_2 \cdot \text{HI} \cdot 3\text{H}_2\text{O}$, which are decomposed in the air into hydrogen iodide and cadmium iodides, but are stable in presence of the mother liquor or in an atmosphere of hydrogen iodide. T. H. P.

Trivalent Thallium. By RICHARD JOS. MEYER (*Zeit. anorg. Chem.*, 1900, 24, 321—368).—Thallium trichloride, obtained by treating the chloride suspended in water with chlorine, crystallises with $4\text{H}_2\text{O}$ when the syrupy solution is cooled in a freezing mixture. The *tetrahydrate* is very hygroscopic, melts at 45° , and solidifies at 33° . The *monohydrate* is obtained by heating the tetrahydrate at 55° , or by crystallisation from solution at the ordinary temperature. It crystallises in lustrous, six-sided tablets, reacts acid to litmus, and when heated at 100° is decomposed with evolution of chlorine. The *hydrochloride*, $\text{TlCl}_3 \cdot \text{HCl} \cdot 3\text{H}_2\text{O}$, crystallises in slender needles, is very hygroscopic, decomposes when heated, and when neutralised with potassium hydroxide yields the salt $\text{TlCl}_3 \cdot 2\text{KCl}$. Thallium trichloride yields with ether and ethyl alcohol the crystalline salts $\text{TlCl}_3 \cdot \text{Et}_2\text{O}$ and $\text{TlCl}_3 \cdot \text{EtOH}$. The anhydrous trichloride is obtained by extracting the ether from the preceding ether compound by means of a vacuum; it crystallises in six-sided plates and melts at 24° . Thallium trichloride yields the double salts $\text{TlCl}_3 \cdot 2\text{KCl} \cdot 2\text{H}_2\text{O}$, $\text{TlCl}_3 \cdot 3\text{KCl} \cdot 2\text{H}_2\text{O}$, $\text{TlCl}_3 \cdot 3\text{NH}_4\text{Cl}$, and the tribromide yields $\text{TlBr}_3 \cdot \text{KBr} \cdot 2\text{H}_2\text{O}$. These salts can be dehydrated until the sum of the water molecules and negative radicles combined with the thallium is reduced to six; any further dehydration then results in decomposition. Only two-thirds of the chlorine is precipitated when a cold aqueous solution of thallium trichloride is treated with silver nitrate.

Compounds of Thallium Trichloride with Organic Bases.—[With C. WIEGAND.]—*Thallium chloride tripyridine*, $\text{TlCl}_3 \cdot 3\text{C}_5\text{NH}_5$, crystallises in white needles and is the most stable of the thallium trichloride compounds towards water. The compound $\text{TlCl}_3 \cdot \text{C}_5\text{NH}_5 \cdot \text{HCl}$ crystallises in white leaflets, the compound $\text{TlCl}_3 \cdot 3\text{C}_5\text{NH}_5 \cdot 3\text{HCl}$ in large, lustrous prisms. The *trianiline chloride*, $\text{TlCl}_3 \cdot 3\text{NH}_2\text{Ph} \cdot 3\text{HCl}$, crystallises in yellow leaflets; the *triethylamine chloride*, $\text{TlCl}_3 \cdot 3\text{EtNH}_2 \cdot 3\text{HCl}$, crystallises in hexagonal prisms and melts at 178° ; the *diethylamine chloride*, $\text{TlCl}_3 \cdot 2\text{Et}_2\text{NH} \cdot 2\text{HCl}$, melts at 112° .

Thallium tribromide, $\text{TlBr}_3 \cdot \text{H}_2\text{O}$, obtained by shaking thallium bromide with bromine water and evaporating in a vacuum with repeated additions of bromine in order to prevent reduction, crystallises in slender needles and is very unstable. The salt $\text{TlBr}_3 \cdot \text{TlBr}$, obtained by evaporating a solution of the tribromide in a vacuum as long as bromine is evolved, crystallises in red leaflets and is decomposed when treated with water. The following *chlorobromides* are described: $\text{TlCl}_3 \cdot 2\text{TlBr} \cdot \text{TlCl}$, $\text{TlBr}_3 \cdot 2\text{TlCl} \cdot \text{TlBr}$, $(\text{TlCl}_3 \cdot \text{TlCl}) \cdot 2(\text{TlBr}_3 \cdot \text{TlBr})$, and $2(\text{TlCl}_3 \cdot \text{TlCl}) \cdot (\text{TlBr}_3 \cdot \text{TlBr})$.

Thallium trinitrate, $\text{Tl}(\text{NO}_3)_3 \cdot 3\text{H}_2\text{O}$, obtained by dissolving the oxide in nitric acid, crystallises in white, lustrous crystals, effloresces on exposure to the air with evolution of nitric acid, and is a strong oxidising agent. The salt, $\text{Tl}(\text{NO}_3)_3 \cdot 2\text{KNO}_3 \cdot \text{H}_2\text{O}$, separates in large, transparent crystals. E. C. R.

Amalgams. By WILHELM KERP and WILHELM BÖTTGER (*Zeit. anorg. Chem.*, 1900, 25, 1—71. Compare Abstr., 1898, ii, 516).—I. [With H. WINTER.]—The following crystalline amalgams have been prepared and analysed, and the temperatures determined at which they are stable when dissolved in mercury. *Sodium amalgam*, at 0° to 40·5° NaHg₆, and at 40·5° to 150° NaHg₅, are obtained from solutions of sodium in mercury. *Lithium amalgam*, LiHg₅, is obtained at all temperatures up to 100°. *Potassium amalgams*, at 0° KHg₁₄, up to 71—73° KHg₁₂, at 73° to 75° KHg₁₀, is obtained, and above 75° the solid amalgam gradually alters in composition with the rise in temperature. *Rubidium amalgams*, below 0° RbHg₁₂ is stable, and above 0° the composition of the solid amalgam varies with the rise in temperature.

II. [With H. IGGENA.]—*Strontium amalgam*, below 30° SrHg₁₂ is stable, and at higher temperatures the composition varies. *Barium amalgams*, below 30° BaHg₁₃, at 30° to 100° BaHg₁₂, are obtained.

III. Definite zinc amalgams were not obtained. *Cadmium amalgam*, Cd₂Hg₇, is obtained at 0° to 44°, and above this temperature indefinite compounds.

These crystalline amalgams have properties corresponding with true chemical compounds; the composition is the same when they are prepared from supersaturated or from non-saturated solutions; they can be recrystallised from mercury without decomposition provided the temperature at which they are decomposed is not exceeded, and they possess properties which differ from those of the alkali or alkaline earth metal from which they are formed, especially in their relative high stability to the action of air and water. The amalgam NaHg₆, when treated with potassium hydroxide at the ordinary temperature, is converted into the amalgam KHg₁₂.

The authors compare these results with those obtained by Maey (Abstr., 1899, ii, 547) and Kurnakoff (this vol., ii, 277). [Compare also Guntz and Ferée, this vol., ii, 540.]

E. C. R.

New Spectra of the Rare Earths. By EUGÈNE A. DEMARÇAY (*Compt. rend.*, 1900, 131, 387—389).—The following lines were observed in the spark spectrum of the brown oxide obtained from the most soluble portions of moderately pure (déjà assez pur) gadolinium magnesium nitrate: $\lambda = 3704\cdot3, 3703\cdot2, 3676\cdot7, 3568\cdot4, 3561\cdot7, 3540\cdot2, 3523\cdot4, 3508\cdot5$. These lines possibly belong to terbium, but since the purity of the material used was indeterminate, they are attributed provisionally to an element denoted by P. In some less coloured oxides, the following lines were observed, possibly belonging to the earth Zy of Lecoq de Boisbaudran: 4212·6, 4195·5, 4187·3, 3978·6, 3945·0, 3595·0, 3550·0, 3531·3. The element producing these lines is denoted by Δ.

In some yttrium, containing fractions intermediate in solubility between holmium and erbium, two intense lines, 3967·9 and 3930·9 were recorded, belonging to the hypothetical element "Ω." In the spectra of the slightly basic earths, intermediate between erbium and ytterbium, the two lines 4008·2 and 3906·5 are very intense; these are attributed to an element "Θ."

W. A. D.

Hydrates of Manganous Iodide. By P. KUZNETZOFF (*J. Russ. Phys. Chem. Soc.*, 1900, 32, 290—297. Compare Abstr., 1899, ii, 658).—On cooling a solution of manganous iodide saturated at 0°, the tetrahydrated salt first separates out, and at -5° colourless, prismatic columns of the hexahydrate are obtained; they are very deliquescent, and at -2.7° decompose into the tetrahydrate and a saturated solution of the salt. When a solution containing 63.18 per cent. of the anhydrous salt is cooled to -40° or -45°, crystals are separated, and on adding some of these to the mother liquor at a temperature of -20.5°, there is slowly deposited stout, colourless plates of the nonhydrated salt having the melting point -9.3°.

T. H. P.

Osmond and Roberts-Austen's Theory of Iron-carbon Alloys. By E. HEYN (*Chem. Centr.*, 1900, ii, 163—164; from *Stahl und Eisen*, 20, 625—636).—The paper contains a description of Roberts-Austen's methods and results.

The fact that when the iron-carbon alloy is rapidly cooled there is no separation of graphite may possibly be explained by assuming another line of solidification for the separation of a mixture of a solid solution of 1.2 per cent. carbon in iron (Fe_γ) with cementite. Such a hypothesis accords well with the want of flexibility of white irons whose sections show veins of cementite containing small particles of perlite and embedded in a matrix of perlite. As the iron-carbon alloys are allowed to cool after solidifying, the curves show several well marked breaks in continuity corresponding on the one hand with the separation of ferrite from the solution of 1.2 per cent. carbon in iron (Fe_γ) and on the other with the separation of carbide (cementite) and of a eutectic mixture of ferrite and cementite. These breaks are best explained by assuming the existence of three allotropic modifications of iron. The α -form exists at the ordinary temperature, whilst the γ -form is completely converted into the β -form at about 900° in the case of iron almost free from carbon. The position of these points in the curve is, however, considerably affected by a larger amount of carbon. For instance, in the case of alloys containing 0.8 per cent. of carbon, the solid solution of carbon in γ -iron (martensite) separates into α -iron (ferrite) and cementite thus forming perlite. Alloys with less than 0.35 per cent. of carbon show three breaks in the curve, the first corresponding with a separation of β -iron from the solid solution of carbide in γ -iron, the second with the conversion of β -iron into α -iron, and the third with the decomposition of the residual solid solution of carbon or carbide in γ -iron into its components, α -iron (ferrite) and cementite. The internal structure of the crystals often found in the cavities also corresponds with these secondary changes, for their section shows a mixture of ferrite and perlite formed from the solid solution of carbon in iron.

E. W. W.

Oxidation of Salts of Cobalt and of Cerium in Alkaline Solution. By ANDRÉ JOB (*Ann. Chim. Phys.*, 1900, [vii], 20, 205—264).—A detailed account of work already published (Abstr., 1899, ii, 51, 61, 291, 334, 486).

W. A. D.

Supposed Decomposition of Nickel Sulphate by Light. By D. DOBROSERDOFF (*J. Russ. Phys. Chem. Soc.*, 1900, 32, 300—301).—The generally accepted statement that ordinary heptahydrated nickel sulphate is decomposed by the action of light is shown by the author to be erroneous. If the crystals occupy only a small portion of the containing vessel, they lose water with the formation of the hexahydrate, whether they are exposed to light or not. On the other hand, they are not changed, even by strong light, if the surrounding air is saturated with water vapour or if the crystals are in contact with filter paper moistened with turpentine, or if they completely fill the vessel containing them. T. H. P.

The Blue Oxide of Molybdenum. By MARCEL GUICHARD (*Compt. rend.*, 1900, 131, 389—392 and 419—421. Compare this vol., ii, 597).—The blue oxide of molybdenum, when hydrated, has the composition $\text{MoO}_3 \cdot 4\text{MoO}_3 \cdot 6\text{H}_2\text{O}$, and is thus a molybdenum dimolybdate, as considered by Berzelius. It is best obtained by mixing cold, dilute hydrochloric acid solutions of molybdenum dioxide and ammonium molybdate; the hydrochloric acid should be that of sp. gr. 1.18 diluted with 9 parts of water, this bringing about complete precipitation without decomposition. Stronger acid decomposes the oxide. The product thus obtained is nearly insoluble in cold water, although that prepared by Rammelsberg's method, by precipitation at 50° , is easily soluble; an aqueous solution of the oxide is readily obtained by leaving molybdenum trioxide and metallic molybdenum in contact in water.

The oxide obtained by precipitation is a dark blue powder of sp. gr. 3.6 at 18° ; by the evaporation of its solution, it is obtained in vitreous, faceted fragments, which yet are not truly crystalline. It dissolves in water at 50° , but is insoluble in saturated solutions of ammonium, sodium and calcium chlorides, and potassium iodide and nitrate; sodium and magnesium sulphate do not alter its solubility. It dissolves in alcohol of 95° , although insoluble in most organic solvents. When heated in a vacuum or an inert gas, it loses part of its water at 100° , and the rest near a red heat, a non-homogeneous mixture of molybdenum dioxide and trioxide being formed. Hydrogen reduces it ultimately to the metal; chlorine yields the volatile oxychloride, MoO_2Cl_2 , and molybdenum trioxide. Contrary to Berzelius' statement, it slowly oxidises in the air, and at a red heat oxygen rapidly converts it into the trioxide. Gaseous hydrogen chloride at a red heat and superheated steam decompose it, giving mixed dioxide and trioxide; gaseous ammonia gives initially the same result, but at a red heat reduces the oxides to the metal. Acetic acid does not affect it; by concentrated hydrochloric acid, it is dissolved to a yellowish-red solution of molybdenum tetrachloride, but the action is a reversible one, since, on diluting with water, the blue oxide is precipitated. With sulphuric acid, a like result is obtained. W. A. D.

Fluoro-hyperuranium Compounds. By S. LORDEKIPANIDZÉ (*J. Russ. Phys. Chem. Soc.*, 1900, 32, 283—287).—By the interaction of equivalent proportions of sodium fluoride and uranium oxyfluoride, UO_2F_2 , the double compound, $\text{UO}_2\text{F}_2 \cdot \text{NaF}$, is obtained, which, when dissolved in water, gives with hydrogen peroxide an intensely yellow

solution; on evaporating the latter on a water-bath at 60—70°, a yellow, granular *precipitate* is thrown down, giving on analysis the composition $\text{UO}_2\text{NaF}_5\text{H}_2\text{O}$. Four mols. of water are lost at 100°.

The addition of excess of hydrogen peroxide to an aqueous solution of the double salt, $\text{UO}_2\text{F}_2 \cdot 3\text{KF}$, gives an intensely yellow liquid which after some time deposits a yellow, pulverulent *double compound*, $\text{K}_4\text{U}_4\text{F}_{16} \cdot 4\text{H}_2\text{O}$ or $3(\text{UO}_2\text{KF}) \cdot \text{UO}_3\text{F}_2 \cdot \text{KF} \cdot 4\text{H}_2\text{O}$. T. H. P. 21

Cause of the Loss in Weight of Commercial Platinum when heated under some Conditions. By ROBERT W. HALL (*J. Amer. Chem. Soc.*, 1900, 22, 494—501).—A series of experiments is described in which platinum wires enclosed in glass tubes were heated strongly by means of an electric current, various gases being passed through the tubes; it was found that the loss of weight of platinum in carbon monoxide or dioxide is zero or very little, that in hydrogen there is a very slight gain, whilst in air or oxygen the loss is rapid. Berliner (*Ann. Phys. Chem.*, 1888, [ii], 33, 287) found that when platinum which has been exposed to air is heated in a vacuum, gas is evolved and platinum deposited on the glass cylinder surrounding the metal; he also made the observation, which the present author is unable to confirm, that the behaviour of platinum in hydrogen is exactly the same, and therefore concluded that the action is purely mechanical and caused by the escaping gases. When the platinum wire is heated in air or oxygen, there is always produced on the glass tube a lustrous metallic deposit, which, as observed by Nahrwold (*Ann. Phys. Chem.*, 1887, [ii], 31, 467), is only partially soluble in aqua regia.

From the results of these experiments, it seemed probable that an oxidising gas-flame would cause a greater loss of platinum than a reducing one, and this was proved to be the case by observing the loss of weight of a platinum crucible when heated in different parts of the blow-pipe flame.

The author considers that the behaviour of platinum when heated is best explained by the hypothesis that a volatile oxide is formed, stable at high and low temperatures, but unstable at intermediate temperatures, like the platinous chloride of Troost and Hautefeuille (Abstr., 1877, ii, 273). E. G.

Platinum Compounds of Hydroxylamine. By RUDOLF UHLENHUTH (*Annalen*, 1900, 312, 235—236. Compare this vol., ii, 485).—An explanatory note relative to a claim for priority by Lossen and Alexander. M. O. F.

Ruthenium and its Compounds. III. By UBALDO ANTONY and ADOLFO LUCCHESI (*Gazzetta*, 1900, 30, ii, 71—76. Compare Abstr., 1899, ii, 299).—During the conversion of ruthenium sulphate into ruthenious dithionate (*loc. cit.*) by the action of sulphur dioxide, the colour of the solution changes from bright red through green and violet to azure, after which the liquid is gradually decolorised. On pouring the azure solution into alcohol, a precipitate of the same colour, consisting of *ruthenic sulphite*, $\text{Ru}_2(\text{SO}_3)_3$, is obtained. This compound, which is an intermediate product in the above conversion, is a colloidal substance and dissolves in a large quantity of water,

giving a solution from which it is completely precipitated by the addition of a salt. It can be dried at 80° without change, but when heated in a current of carbon dioxide or nitrogen, it begins to lose sulphur dioxide at 100° , and on stronger heating is completely decomposed, with formation of a brown substance. T. H. P.

Osmium. By ARTHUR ROSENHEIM (*Zeit. anorg. Chem.*, 1900, **24**, 420—424. Compare Abstr., 1899, ii, 664).—Sodium osmichloride, when boiled with concentrated sodium hydrogen sulphite, is converted into the osmisulphite, $[\text{Os}(\text{SO}_3)_6]\text{Na}_8 \cdot 8\text{H}_2\text{O}$. By the prolonged action of excess of sodium hydrogen sulphite at the ordinary temperature, the *chlorosmisulphite*, $\text{OsCl}_2(\text{SO}_3)_4\text{Na}_6 \cdot 10\text{H}_2\text{O}$, is obtained. The same salt is obtained by the action of sodium sulphite on sodium osmichloride at the ordinary temperature.

Potassium hydrogen chlorosmisulphite, $\text{OsCl}_4(\text{SO}_3)_4\text{K}_6\text{H}_2$, obtained by the prolonged action of potassium hydrogen sulphite on potassium osmichloride, crystallises in dark red, monoclinic prisms [$a:b:c = 1.7243:1:1.1729$; $\beta = 105^{\circ}44'$]. When heated with hydrochloric acid, it evolves sulphur dioxide and is converted into potassium osmichloride. E. C. R.

Mineralogical Chemistry.

Anthracite and Anthraxolite from Canada. By W. HODGSON ELLIS and WILLIAM LAWSON (*Proc. Canadian Inst.*, 1898, N.S., 1, 67—68).—A coal-like substance (anthracite) occurring as a vein in Cambrian rocks at Sudbury gave anal. I, sp. gr. 1.865. It resembles a substance (anal. II), called anthraxolite, from near Kingston.

	C.	H.	N.	S.	Ash.	O.	Total.
I.	94.92	0.52	1.04	0.31	1.52	[1.69]	100.00
II.	90.25	4.16	0.52	0.66	0.72	[3.69]	100.00

A proximate analysis of the first of these gave: moisture, 4.00; volatile matter, 1.80; fixed carbon, 90.10; ash, 4.10. L. J. S.

Salt from Lake Djouvan-Tubé. By WLADIMIR B. MARKOWNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1900, **32**, 307—309).—[With K. BAILINSK.]—The salt deposited on the shores of Lake Djouvan-Tubé in the Akmolinsk Province, has the following composition: H_2O (of crystallisation and hygroscopic), 24.30; insoluble residue, 1.90; Cl, 12.39; SO_3 , 33.23; MgO , 5.31; Al_2O_3 , 3.97; FeO , 0.97; CaO , 1.40; Na (by difference), 14.33. T. H. P.

Von-Diestite, a new Mineral. By E. CUMENGE (*Bull. Soc. franç. Min.*, 1899, **22**, 25—26).—This occurs with ores of copper and auriferous pyrites in the Hamilton and Little Gerald Mines on the Sierra Blanca, Colorado. Analysis by F. C. Knight gave:

Ag.	Bi.	Te.	Au.	Pb.	S.	Insol.	Total.
40.25	16.31	34.60	4.30	2.25	0.54	0.54	98.79

L. J. S.

Löllingite from the Harz. By ROBERT SCHEIBE (*Centr. Min. Geol.*, 1900, 119—120).—A massive mineral, occurring with calcite as a vein in gabbro at Radau-thal, is proved to be cobaltiferous löllingite by analysis I. With it are small crystals, of which the angular measurements agree more closely with mispickel than with löllingite; a partial analysis of these crystals gave II:

	As.	Sb.	S.	Fe.	Co.	Ni.	Bi.
I.	70.16	0.29	1.20	23.75	4.13	0.20	trace.
II.	—	—	7.8	—	3.5	—	—

L. J. S.

Colours of Minerals. By ARNOLD NABL (*Tsch. Min. Mitth.*, 1900, 19, 273—276).—The author has suggested that the colour of amethyst may be due to ferric thiocyanate (Abstr., 1899, ii, 561), but L. Wöhler and K. von Kraatz-Koschlaw (*Tsch. Min. Mitth.*, 1899, 18, 449) have failed to detect the presence of sulphur. The author has repeated his experiments, and finds distinct indications of sulphur. Also by heating amethyst at 180° he obtained 0.025 per cent. of nitrogen.

L. J. S.

Analyses of Corundum and Corundum-bearing Rock. By WILLIAM L. GOODWIN (*Rept. Bureau Mines, Toronto*, 1898, 7, 238—239. Compare this vol., ii, 552).—Crystals of corundum from Eastern Ontario gave the following results on analysis. Silica is also present (0.05—0.09 per cent.), and sometimes small quantities of cerium earths.

Al ₂ O ₃ .	Fe ₂ O ₃ .	Insol.	Loss on ignition.
96.92	—	1.36	2.43
96.26	0.36	—	1.93
97.23	0.32	—	—

Analyses are also given of the corundum-bearing rock.

L. J. S.

Phosphorescent Dolomite from Elba. By GIOVANNI D'ACHIARDI (*Jahrb. Min.*, 1900, ii, Ref. 14; from *Proc. Verb. Soc. Toscana Sci. Nat.*, 1899, 11, 156—157).—This occurs as a band in crystalline limestone at Valdana near Portolongone and at Capo Calamita. It is pale yellowish with black spots of foreign material, and is very fine grained and friable; when rubbed, it is strongly phosphorescent. Analyses gave:

CaO.	MgO.	Mn ₂ O ₄ + Fe ₂ O ₃ .	Loss on ignition (H ₂ O + CO ₂).	Insol. in HCl.	Total.
29.09	22.60	0.83	46.26	0.79	99.57
29.86	21.09	1.33	46.03	1.04	99.35

L. J. S.

[Turquoise and Phosphorochalcite.] By THEODOR PETERSEN (*Jahrb. Min.*, 1900, ii, Ref. 31; from *Jahresber. physik. Ver. Frankfurt a. M.*, 1896—1897, 1898, 4 pp.).—Sky-blue or green turquoise occurring as veins in weathered porphyrite at Borrow Mts., New Mexico, gave analysis I, which, after deducting 4CuO, P₂O₅ and 3CaO, P₂O₅, agrees with the formula 2Al₂O₃, P₂O₅, 5H₂O. When heated, it decrepitates violently and falls to dark brown powder.

Crystalline phosphorochalcite ("ehlite"), occurring sparsely in a quartz vein in sericite-schist at Frauenstein near Wiesbaden, gave II, agreeing with the formula $5\text{CuO}, \text{P}_2\text{O}_5, 3\text{H}_2\text{O}$. No water is lost below 150° .

	P_2O_5	Al_2O_3	Fe_2O_3	CuO	CaO	$\text{MgO}, \text{K}_2\text{O}, \text{Na}_2\text{O}$	SiO_2	Loss on ignition.	Total.
I.	27.09	32.14	1.33	4.92	5.23	0.89	8.71	15.58	99.89
II.	24.16	—	—	67.08	—	—	—	9.03	100.27

L. J. S.

A Mineral of the Columbite Group. By WILLIAM L. GOODWIN and WILLET G. MILLER (*J. Fed. Canadian Mining Inst.*, 1898, 3, 151—152; and *Rept. Bureau Mines, Toronto*, 1898, 7, 234—237).—This was found embedded in the felspar of a pegmatite containing also beryl, tourmaline, &c., at Lyndoch, Renfrew Co., Ontario. Sp. gr. 5.38. Analysis gave:

$(\text{Nb}, \text{Ta})_2\text{O}_5$	SnO_2	FeO	MnO	CuO	$(\text{Ce}, \text{Di}, \text{Y})_2\text{O}_3$	Total.
75.75	0.92	11.14	10.22	0.03	2.00	100.16

L. J. S.

Fedorowite. By CARLO VIOLA and E. H. KRAUS (*Zeit. Kryst. Min.*, 1900, 33, 36—38).—The new name fedorowite was originally given to a pyroxene which, from its optical characters, should have occupied a place between ægirine-augite and ægirite (Viola, *Jahrb. Min.*, 1899, i, 121). The following analysis (mean of two), however, shows that it resembles diopside in composition. The light green crystals occur in various volcanic rocks in the province of Rome; they are strongly pleochroic, and the angle of optical extinction on $b(010)$ is $c:r = 65-75^\circ$; $2V < 50^\circ$.

SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	Total.
52.36	2.42	2.24	1.94	24.57	14.53	2.29	100.35

Fedorowite is therefore now defined as a pyroxene with the composition of diopside, but with optical characters approaching those of ægirite.

L. J. S.

Pyroxene from Moravia. By A. PELIKAN (*Tsch. Min. Mitth.*, 1900, 19, 338—339).—The following analysis by R. von Zeynek proves a pyroxene from crystalline limestone at Altstadt, Moravia, to be diopside. The same material is described crystallographically in an earlier paper (*Tsch. Min. Mitth.*, 1899, 19, 106—110).

SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	H_2O	C.	Total.
51.76	1.65	0.35	0.69	25.78	18.35	0.86	0.51	0.52	100.47

L. J. S.

Pyroxene from Latium. By FERRUCCIO ZAMBONINI (*Zeit. Kryst. Min.*, 1900, 33, 39—56).—Detailed crystallographic descriptions are given of the black and of the green crystals of monoclinic pyroxene from the volcanic rocks near Rome. Analysis of the black crystals gave I, and of the light green II. Another light green crystal of the same tint as II contained only 4.37 per cent. FeO ; green crystals which are darker in colour contain more iron.

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	MnO.	CaO.	MgO.	Total.
I.	48.86	0.37	5.23	1.71	10.02	0.23	24.34	8.35	99.12
II.	—	—	—	0.60	5.58	—	—	—	—

There appears to be no connection between the amount of iron and the angle of optical extinction. The crystals contain enclosures of magnetite, &c.

L. J. S.

Felspar Studies. By CARLO VIOLA (*Zeit. Kryst. Min.*, 1900, 32, 305—337).—Crystallographic and optical determinations of albite are given. Analysis I is of albite, from Amelia Co., Virginia; II, of pericline from the Kramkogel, Rauris, Salzburg.

	SiO ₂	Al ₂ O ₃	CaO.	MgO.	Na ₂ O.	K ₂ O.	Total.
I.	67.75	19.96	0.51	0.10	11.06	—	99.38
II.	67.81	20.35	0.68	0.42	10.92	0.32	100.50

L. J. S.

Composition of Tourmaline. By HEINRICH BEERMANN (*Jahrb. Min.*, 1900, ii, Ref. 26; from *Inaug.-Diss. Erlangen*, 1899, 37 pp. Compare this vol., ii, 602).—The following analyses of tourmaline are given. I. Black tourmaline from Epprechtstein, Fichtelgebirge; sp. gr. 3.1241. II. Rose-red tourmaline from Wolkenburg, Saxony; sp. gr. 3.106. III. Black tourmaline from Vitosa, Sofia.

	SiO ₂	Al ₂ O ₃	B ₂ O ₃	MnO.	CaO.	MgO.	FeO.	Na ₂ O.	K ₂ O.	Li ₂ O.	H ₂ O.	HF.	P ₂ O ₅
I.	36.36	32.29	9.50	—	0.46	2.60	14.32	1.39	0.66	—	1.95	—	0.06
II.	37.99	42.25	10.05	0.34	0.45	0.16	0.15	2.60	0.51	1.30	4.20	0.30	—
III.	36.29	32.18	10.14	1.50	0.42	2.04	13.13	1.41	0.40	0.08	2.40	—	—

Complicated formulæ in accordance with Rheineck's views (*Abstr.*, 1899, ii, 601) are given.

L. J. S.

Alkali-syenite from Massachusetts. By FRED. EUG. WRIGHT (*Tech. Min. Mitth.*, 1900, 19, 308—320).—Alkali-syenite (umptequite) occurring at Beverley, Massachusetts, consists essentially of microperthite and an alkali-hornblende, with some microcline, diopside, lepidomelane, apatite, zircon, &c. Analysis of the rock gave II; sp. gr. 2.732. The alkali-hornblende is greenish-black; sp. gr. 3.44; in its optical characters ($\epsilon : c = 20^\circ 35'$, $2E = 63^\circ 22'$, &c.) and composition, anal. I giving the formula



it is related to barkevikite, arfvedsonite, and hastingite (*Abstr.*, 1896, ii, 374).

	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO.	MnO.	CaO.	MgO.	Na ₂ O.	K ₂ O.	H ₂ O.	Total.
I.	35.42	1.34	8.89	9.73	24.48	1.17	6.93	0.17	5.13	3.23	8.15	99.64
II.	62.99	0.16	14.25	2.78	5.15	0.18	2.72	1.30	4.86	6.35	0.18	100.92

L. J. S.

New Variety of Garnet. By W. A. MACLEOD and O. E. WHITE (*Papers and Proc. R. Soc. Tasmania*, for 1898—1899, 1900, 74—76).—A trachyte, from Port Cygnet, Tasmania, consisting of sanidine and biotite, contains numerous crystals of brownish-yellow garnet, which show trapezoidal faces and are sometimes $\frac{1}{4}$ in. diam. Analysis of the garnet gave I, and of the rock II. In the relative proportions of the bases, this differs from other garnets, and the name *johnstonotite* (after

R. M. Johnston) is proposed. [The formula, however, only approximates to the garnet formula even when all the iron is calculated as Fe_2O_3 .]

	SiO_2	Al_2O_3	FeO	MgO	CaO	MnO	Na_2O	K_2O	Ign.	Total
I.	36.87	7.28	17.12	12.49	11.98	18.68	—	—	0.29	99.71
II.	55.87	18.21	8.01	0.46	4.54	2.61	3.36	5.75	2.28	101.09

L. J. S.

[Ivaarite.] By VICTOR HACKMAN (*Bull. Comm. Géol. Finlande*, 1900, No. 11, 11).—The following mineral analysis is given in a petrological paper (pp. 1—45) on the rocks associated with ijolite at Iivaara, Kola Peninsula, Finland. Ivaarite (Iiwaarit) occurs as an accessory constituent in the ijolite (a holocrystalline nepheline-pyroxene rock); the following analysis, by M. Dittrich, gives further proof of the identity of ivaarite with schorlomite.

	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Total
	27.35	16.44	1.50	20.09	2.90	trace	0.82	30.99	100.09

L. J. S.

Meteoric Irons. By EMIL W. COHEN (*Ann. k. k. naturhist. Hofmus. Wien.*, 1900, 15, 74—94).—New analyses by J. Fahrenhorst are given of the following irons.

Salt River, Kentucky. In structure (octahedral with fine lamellæ) and composition (anal. I) this resembles the Ballinoo and Tocavita irons, (Abstr., 1898, ii, 440; 1899, ii, 307). Sp. gr. 7.6648.

Cape of Good Hope. Anal. II. Sp. gr. 7.8543. This resembles the Kokomo and Iquique irons.

Babb's Mill, Green Co., Tennessee. Analysis III and IV are of material from different portions of the mass described by Blake in 1886 under the name Green County; V is of the Babb's Mill mass described by Troost in 1845. Although these differ considerably in chemical composition, they probably represent the same fall since both belong to the rare type of ataxites rich in nickel.

	Fe.	Ni.	Co.	Cu.	Cr.	C.	S.	P.	Cl.	Total.
I.	90.89	8.70	0.85	0.04	0.00	0.02	trace	0.34	—	100.84
II.	82.87	15.67	0.95	0.08	0.04	0.03	0.00	0.09	0.01	99.69
III.	88.41	11.09	0.66	undet.	0.02	0.03	trace†	trace	0.02	100.23
IV.	88.23	11.01	0.72	undet.	0.02	0.03	trace†	trace	0.01	100.02
V.	81.45	17.30	1.67	0.03	0.03	0.07	0.01	0.12	undet.	100.68

L. J. S.

Melonite from South Australia. By ARTHUR DIESELDORFF (*Zeit. prakt. Geol.*, 1899, 423; and *Centr. Min. Geol.*, 1900, 98—100).—Melonite has recently been found in association with auriferous ores at Worturpa (this vol., ii, 283). Sp. gr. 7.403. The following analyses by G. A. Goyder are quoted from *The Chronicle*, Adelaide.

	Ta.	Sa.	Ni.	Co.	Fe.	Au.	SiO_2	Total.
	77.52	2.49	19.11	0.10	0.68	0.07	0.08	100.05
	80.46	undet.	18.12	0.03	0.68	undet.	0.74	100.03

L. J. S.

Physiological Chemistry.

Mass and Oxygen Capacity of Blood in Man. By JOHN S. HALDANE and J. LORRAIN SMITH (*J. Physiol.*, 1900, 25, 331—343).—A full account of experiments previously published (this vol., ii, 416). The main conclusions are the following: The mass of the blood in man is about 4.9 per cent. of the body weight, and varied in fourteen persons from 3.34 to 6.27. The total oxygen capacity of the blood in litres is 0.85 per cent. of the body weight in kilograms, and varied between 0.57 and 0.95. The percentage oxygen capacity is 18.5 per cent., the limits being 16.0 and 20.9. The oxygen capacity of blood, even from different animals, varies in direct proportion to its colouring power, and may be accurately determined colorimetrically by reference to blood of known oxygen capacity. W. D. H.

Absorptive Power of Hæmoglobin for Oxygen and Carbon Monoxide. By L. G. DE SAINT MARTIN (*Compt. rend.*, 1900, 131, 506—509).—One gram of hæmoglobin always absorbs the same volume of both oxygen and carbon monoxide. Although the absorptive power for the two gases is equal, it is not a fixed quantity. G. Hüfner (*du Bois Reymond's Archiv*, 1894, 130) gives, as the result of a number of observations, the number 1.34, which represents the number of c.c. of oxygen absorbed by 1 gram of hæmoglobin. In the present research, the numbers obtained in seven observations on dogs' blood are respectively 1.35, 1.22, 1.35, 1.33, 1.34, 1.20, and 1.35. The figures obtained from various pathological specimens of human blood are as follows: 1.305, 1.19, 1.33, 1.26, 1.22, 1.18, 1.26, 1.34. This variation cannot be accounted for by any change in the blood-pigment that can be detected by the spectro-photometer. W. D. H.

Agglutination of Blood Corpuscles by Chemical Agents. By E. HÉDON (*Compt. rend.*, 1900, 131, 290—292).—In solutions of non-dissociable substances, such as sugar, very weak doses of acid (mineral or organic) produce agglutination of blood-corpuscles, but in solutions of electrolytes, such as salts, this is not the case. The addition of a certain quantity of neutral salt in the former case prevents the agglutination, or, if agglutination has occurred, produces disagglutination. W. D. H.

Changes in the Composition of the Blood after Transfusion of Sodium Chloride, and their Relationship to Diuresis. By R. MAGNUS (*Chem. Centr.*, 1900, i, 1036; from *Arch. exp. Path. Pharm.*, 44, 68—103).—The experiments recorded were made on dogs. If large quantities of blood are first withdrawn, the blood drawn subsequently is more dilute; but if the first withdrawal does not exceed 8 per cent. of the total blood in the animal, the blood drawn afterwards is more concentrated; this is due to increase in the amounts of hæmoglobin and proteid; the proportion of salts is not altered. After transfusion of 0.9 per cent. solution of sodium chloride, there is

diuresis, and proportionally more sodium chloride is excreted than water. Stronger salt solutions produce less diuresis. In some cases, sugar appears in the urine. After the injection of hypotonic solutions, the osmotic pressure sinks, and remains low until the diuresis comes to an end. The capillary wall has, therefore, the power to rapidly regulate the osmotic pressure of the blood. Diuresis is a result of dilution of the blood. By the use of strong salt solutions, water enters the blood from the tissues.

W. D. H.

Functions of the Nucleus in Relation to Hæmoglobin Formation and Cellular Protection. By HENRI STASSANO (*Compt. rend.*, 1900, 131, 298—301).—In studying the absorption of iron saccharate in the peri-oesophageal membrane of the frog, it was noticed that the nuclei of the endothelial cells and of the blood-corpuscles absorb the iron. In the case of the blood-corpuscles, the chromatin of the nucleus diffuses into the cell-protoplasm in order to combine with the salt injected. The same diffusion of chromatin was noted in certain changes of environment (reaction, temperature, &c.) of the corpuscles. The nucleus is believed, therefore, to be a protective agent, as well as being concerned in the assimilation of nutriment and elaboration of hæmoglobin.

W. D. H.

Influence of Acids on the Amylolytic Action of Saliva. By G. A. HANFORD (*Amer. J. Physiol.*, 1900, 4, 250—260).—It is not possible to designate any percentage of acid or alkali which inhibits salivary digestion in a definite degree. The character of the action is dependent also on the absolute amount of the saliva and the attendant variation in the quantity of proteid matter present. Whenever free hydrochloric acid is present, more or less complete inhibition is certain to result.

W. D. H.

End Products of Gastric Digestion. By MEINHARD PFAUNDLER (*Zeit. physiol. Chem.*, 1900, 30, 90—100).—Attention has been recently directed to the question of the nature of the substances formed during peptic activity which do not give the biuret reaction. In the present research, the digestion was allowed to go on for some months, the albumoses were removed by zinc sulphate, and the peptone by iodine or by phosphotungstic acid; the last-named substance precipitates other products also. In the case of serum-albumin, the final filtrate contained 39.7 per cent. of the total nitrogen. Among the products separated out were leucine and a diamino-acid, probably histidine. In the case of fibrin, leucine was not found. The principal end products appear to be substances intermediate between peptone and the amino-acids; these do not give the biuret reaction, and contain more than one carbon nucleus; in the case of serum albumin at least, a leucine and diamino-nucleus are present.

W. D. H.

Quantitative Relationships of Pepsin Activity. By JULIUS SCHÜTZ (*Zeit. physiol. Chem.*, 1900, 30, 1—14).—E. Schütz (Abstr., 1885, 1147) stated that the amount of the products of peptic activity was proportional to the square root of the amount of pepsin. The method used was to estimate the products by their rotatory power. This statement has been but little credited. It was, however, con-

firmed by Borissow (*Inaug. Diss. Petersburg*, 1891), who used Mett's capillary tube method. In the present research, various proteids were used, and the amount of digestive products was estimated by nitrogen determinations. The rule is again confirmed, and it is believed to hold for other enzymes also. One example will suffice :

Amount of solution of pepsin in c.c.	Digested nitrogen in grams.	
	Found.	Calculated.
1	0.0230	0.0223
4	0.0427	0.0446
9	0.0686	0.0669
16	0.0889	0.0892

W. D. H.

Nutritive Value of Hetero-albumose from Fibrin, and Proto-albumose from Casein. By LEON BLUM (*Zeit. physiol. Chem.*, 1900, 30, 15—44).—The experiments were performed on a dog. They show that all proteoses have not the same nutritive value, and that of the two investigated, the caseose is the more valuable. The following table illustrates this :

Food.	Nitrogen.		Balance.
	Intake.	Output.	
1a. Meat	14.12	13.81	+ 0.31
1b. Hetero-albumose ...	14.12	15.30	- 1.18
2a. Meat	14.7	14.0	+ 0.7
2b. Proto-caseose	14.7	14.4	+ 0.3

A discussion follows as to why this should be. Investigation of the substances given as food in relation to the way in which their nitrogen is combined by Hausmann's method did not yield an answer to the question.

W. D. H.

Comparative Absorption [Digestibility] and Velocity of Hydrolysis of Certain Fats. By H. LÜHRIG (*Chem. Zeit.*, 1900, 24, 646—648. Compare this vol., ii, 224, 355 ; Kreiss and Wolf, *ibid.*, 324).—According to König, butter is readily digested because it is so easily hydrolysed. Comparative experiments made by the author on butter, margarine, lard, cotton-seed oil, sesame oil, and cocoanut butter indicate that in all five cases the hydrolysis proceeds similarly and to appreciably the same extent when cold alcoholic potash of a given strength is employed. There thus appears to be no relationship between the ease with which a fat is absorbed and the readiness with which it is hydrolysed.

J. J. S.

Absorption of Coloured Fats. By EDUARD PFLÜGER (*Pflüger's Archiv*, 1900, 81, 375—380).—Hofbauer (this vol., ii, 605) has stated that fat particles are absorbed as such, for if the fat is artificially coloured, the fat droplets in the epithelial cells are still coloured. The pigments used are insoluble in water. The present research shows that although the pigments are insoluble in water they are soluble in bile, in soaps, and in glycerol. Hofbauer's work gives therefore no proof that fat is absorbed as an emulsion.

W. D. H.

Absorption of Fat. By HANS FRIEDENTHAL (*Centr. Physiol.*, 1900, 14, 258—261).—Hofbauer's work, although conclusive at first sight, really does not solve the question of fat-absorption. The absorption of fat in the large intestine where there is an absence of steapsin (Hemmeter, this vol., ii, 607) either shows that neutral fat can be absorbed as such, or that the first part of the epithelial cells is analytic, and the deeper portion synthetic in its action. The main objection to Hofbauer's method is that the pigments he used are soluble, not only in fat, but also in fatty acid. This is regarded as a more important objection than those urged by Pflüger (see preceding abstract). In fact, it is stated that alkanna is not soluble in soaps unless free fatty acid is present as well. W. D. H.

Formation of Fat in the Animal Organism by Intensive Feeding of Fat. By V. HENRIQUES and C. HANSEN (*Expt. Stat. Record*, 1900, 11, 674—676; from 44^{te} *Ber. k. Vet. Landbohøjsk. Lab. Landökon. Forsög.*, 1899).—Two pigs (3 months old) were fed during 168 days with ground barley and melted cocoanut, or linseed oil mixed with water. At suitable intervals a few grams of fat were taken from the backs of the animals and examined. The daily amount of oil was gradually increased from 125 to 400 grams.

The results showed that linseed oil was present in the newly-formed fat. At the conclusion of the experiments, when the animals were killed, large quantities of sativic acid (hydroxylinoleic acid) were found in the fatty tissue.

The iodine numbers for the fat of pig (1), which had cocoanut oil all the time, were: October 10, 70.3; December 12, 57.5; December 30, 71.8; February 1, 92.8, and March 17, 100.3. The refraction numbers at the same dates were 60.5, 56.9, 60.6, 64.2, and 65.4. The second pig, which had linseed oil until December 9, and afterwards cocoanut oil, gave the following results: iodine numbers, 70.9, 109.2, 88.3, 83.8, and 69.7; refraction, 60.8, 66.7, 64.2, 62.2 and 59.8.

Experiments with two cows are also described. The one had 0.5 kilo. of emulsified linseed oil in addition to hay, ground barley, and linseed meal, the other 0.5—1 kilo. of oil. During the first 4—6 days, the percentage of fat in the milk was increased in some cases by almost 1 per cent.; subsequently, however, the percentage of fat became normal, notwithstanding that feeding with oil was being continued. The yield of milk changed in the same manner as the percentage of fat in the milk.

During the feeding with oil the volatile fatty acids of the butter fat greatly decreased; the lowest Reichert numbers obtained were (cow 1) 16.5, and (cow 2) 12.5 for 5 grams of fat. The amounts of volatile fatty acids only slowly became normal after the oil-feeding was discontinued. The iodine number and index of refraction changed rapidly both with oil feeding and after it was discontinued; the highest iodine number obtained was 70.4. The melting point of the butter fat increased from 35.4° (normal food) to 39° (linseed oil, 0.5 kilo.). Sativic acid was found only in small quantities in the butter fat; there was therefore no important transfer of food fat to the milk. At the same time, the results of the Hübl test showed

that Soxhlet's theory is wrong, since the iodine number of beef fat is 40, whilst that of the butter fat obtained during the oil-feeding was about 58. Partially starved cows yield milk in which the amount of volatile fatty acids remains practically unchanged, whilst the iodine number is raised and the melting point lowered. This would seem to indicate a migration of the liquid constituents (olein) of the fatty body-tissue to the milk.

The conclusion is drawn that when much fat is supplied in the food, it is secreted as milk fat after having been transferred to the blood. The transmission is not, however, direct; in the alveolar cells of the milk gland, the fat will be transformed in such a manner that much olein and a small amount of fat having a high melting point (stearin ?) are formed. Large amounts of drying oil in the food will be changed to non-drying oils before being secreted in the milk. N. H. J. M.

Origin of Volatile Fatty Acids in Butter. By NATHAN ZUNTZ and Usow (*Chem. Centr.*, 1900, i, 1135; from *Arch. Anat. Phys. Physiol. Abth.*, 1900, 382—384).—It is well known that the fat of cow's milk is rich in lower glycerides, whilst that of human and dog's milk is not. In the expectation that this might depend on the absorption of lower fatty acids produced by fermentation from carbohydrates during digestion, a dog was fed on butter, butyric acid, and sodium butyrate, but the amount of volatile fatty acid did not rise in the milk. It therefore appears that in the cow these volatile acids are actually formed in the mammary glands. W. D. H.

Mineral Metabolism in the Naturally and Artificially Fed Infant. By MAGNUS BLAUBERG (*Zeit. Biol.*, 1900, 40, 1—35, 36—53).—The mineral metabolism in infants is important in view of such diseases as rickets. Observations are here recorded on four children, each fed in a different way; the inorganic constituents of urine and faeces were examined in detail. In one fed on diluted cow's milk, 53·72 per cent. of the saline constituents were absorbed, and the remainder passed away in the faeces. Of the individual salts, the sodium compounds were absorbed best (87 per cent.); the numbers for potassium salts, chlorides, phosphates, and calcium oxide were respectively 67·6, 59·3, 46·6, and 37·25. There is a loss of iron. The proportion is seen to be different from that required by the needs of the organism. The results compare unfavourably with those obtained in another child fed on human milk. The results are still more unfavourable if Kufeke's meal and water are used instead of milk. Here the balance is often on the wrong side (salt-hunger). If undiluted cow's milk is employed, a condition of over-nutrition is noted. W. D. H.

Proteid-Metabolism during Gelatin-Feeding. By JOSEPH KIRCHMANN (*Zeit. Biol.*, 1900, 40, 54—94).—Experiments were performed on a dog to determine to what degree gelatin acts as a proteid-sparing food. The gelatin was practically all absorbed; traces only were found in the faeces. If gelatin in amount corresponding with 12 per cent. of the necessary energy is given, proteid decomposition is lessened by 27 per cent. Increase of the administered gelatin

beyond this lessens proteid katabolism in a proportionally small degree, thus gelatin to the extent of 62 per cent. lessens the proteid decomposition by 35 per cent. This was the maximum obtained. A discussion of the results of previous workers is added. W. D. H.

Influence of Sodium Chloride Solution Injected Subcutaneously on Proteid Metabolism. By OTTO KRUMMACHER (*Zeit. Biol.*, 1900, 40, 173—179).—The question what influence physiological salt solution has on metabolism is important, because it is so frequently used as a vehicle for other substances. Biernacki (*Zeit. Klin. Med.*, *Suppl.* 19, 49—86) states that after injecting 100 to 300 c.c. of a 0·7 per cent. solution of sodium chloride in dogs proteid katabolism is increased by 70 per cent. His methods are criticised, and a repetition of his experiments shows that the increase is very small. Before the injection, the excretion of nitrogen averaged 2·56 grams daily; this was raised to 2·75 by the injection of 210 c.c. of the saline solution. The amount of sodium chloride in the urine was increased.

W. D. H.

Influence of Sodium Salicylate on Metabolism. By FRANCIS W. GOODBODY (*J. Physiol.*, 1900, 25, 399—413).—Sodium salicylate in man causes increased katabolism of proteid material; this leads to an increase of nitrogen, particularly in the form of urea, which is excreted. It does not influence general metabolism, or absorption of fats or proteids.

W. D. H.

Rôle of Arsenic in Connection with the Menstrual Flow. By ARMAND GAUTIER (*Compt. rend.*, 1900, 131, 361—367).—Administration of arsenic improves the skin and its appendages, and lessens the intervals between the menstrual epochs. Much the same is true for iodine. The thyroid is of all the organs the richest in these two elements. Arsenic is absent in healthy blood, except during menstruation, when 0·28 milligram per kilogram of blood are present. Iodine also increases in the menstrual blood. The fall of hair, and epithelial desquamation are in man considered sufficient to balance the arsenic and iodine metabolism of the thyroid. In woman, the balance is assisted by the menstrual flow. Examples are quoted from man and animals to emphasise the inter-relationships of the functions of skin, thyroid, and genital organs.

W. D. H.

Metabolism of Iodine. By PAUL BOURCET (*Compt. rend.*, 1900, 131, 392—394).—Iodine does not exist merely in the thyroid and the blood, but in smaller quantities in most of the tissues and organs. Analytical figures in dog and rabbit are given. A man takes in his food about 0·33 milligram of iodine daily. It is eliminated principally by the epidermis and skin glands; the hair and nails are particularly rich in this element. They contain also about the same quantity of bromine. In woman, where the fall of hair is not such a marked occurrence, the excess is carried off in the menstrual discharge.

W. D. H.

Glycogen Formation after Inulin Feeding. By R. NAKASEKO (*Amer. J. Physiol.*, 1900, 4, 246—250).—The experiments show that

the glycogen-forming properties of inulin in the case of the rabbit are uncertain or minimal.
W. D. H.

Formation of Lactose. By BENJAMIN MOORE and WILLIAM H. PARKER (*Amer. J. Physiol.*, 1900, 4, 239—242).—It has been generally assumed that the mammary glands form, and not merely excrete, lactose, and that this substance when found in the urine arises from absorption from the charged gland cells, but this hypothesis does not appear to have been experimentally demonstrated. The present experiments on goats show that it is well founded. The mammary glands were removed; parturition occurred, but the urine remained practically normal; certainly no lactose was found in it.

W. D. H.

Connective Tissue in Muscle. By J. H. GOODMAN (*Amer. J. Physiol.*, 1900, 4, 260—263).—The connective tissue can be separated from muscle by a simple mechanical process first described by E. Schepilewsky (*Arch. Hyg.*, 1899, 34, 348), and among its constituents this observer describes a mucin. It is here shown, however, that the substance precipitated by acetic acid yields no reducing substance, and contains as much as 16 per cent. of nitrogen; it is therefore not mucin, neither is it a nucleo-proteid. The gelatin obtained gives Millon's reaction; the old statement that gelatin does not give this reaction is incorrect.

W. D. H.

Chemistry of the Brain. By N. ALBERTO BARBIERI (*Compt. rend.*, 1900, 131, 347—349).—When brain matter was kept at 45° for 12—18 hours, carbon dioxide came off to the amount of about 1 c.c. for each gram of brain taken. The residue, on distillation, yields a small quantity of alcohol. The other substances separated are loosely described as (1) the hydrochloride of a ptomaine, (2) a substance of phenolic nature, (3) a crystalline material intermediate between leucine and butalanine, (4) cholesterol, margarine, stearin, olein, (5) a substance with a fishy odour, and (6) a residue which probably consists largely of keratin.

W. D. H.

Thyroid Gland of Sheep. By TH. SUIFFET (*J. Pharm.*, 1900, [vi], 12, 50—53).—With sheep grazed on inland pastures the amount of iodine in the thyroid gland varies from 0.0735 to 0.088 per cent., whilst with sheep from pastures near the sea or near salt marshes it varies from 0.121 to 0.140. It is probable that the high percentage of iodine in the latter case is due to the presence of *Salicornia*, *Salsola soda*, and *Atriplex portulacoides* in the pasturage; an analysis of the ash of these plants, however, will be necessary to confirm this view.

W. A. D.

Fermentative Decomposition of Proteid, and Ammonia Formation in the Liver. By MARTIN JACOBY (*Zeit. physiol. Chem.*, 1900, 30, 149—173).—Changes in the Liver during Phosphorus Poisoning, and their Relation to Autolysis (*ibid.*, 174—181).—Loewi (Abstr., 1898, ii, 617) has stated that by the action of liver ferment solutions on glycine, a substance soluble in ether or

alcohol is obtained which is not urea, but contains easily detachable nitrogen. The present investigation was originally undertaken to determine what this substance is, but resulted in the discovery of an ammonia-forming enzyme in the liver. A number of experiments were performed in which glycine was added to liver juice, in order to see if any increase in the nitrogen which can be driven off by magnesia took place; this was not found. In liver juice preserved by the addition of toluene, it was, however, observed that without any further addition, and in the absence of putrefaction, the amount of this loosely combined nitrogen rose considerably; in one experiment, in which a sample of the aqueous liver extract was examined daily, the amount of this nitrogen rose gradually in 20 days from 0.0013 gram to 0.00675 per 20 c.c. This does not occur when the extract is boiled and then kept. The nitrogen is found to correspond in amount mainly with the quantity of ammonia newly formed, and this arises from an increase of amino-nitrogen and a lessening of proteid. In fact, it is believed that this is a case of Salkowski's auto-digestion or autolysis, and will occur, not only in extracts, but also in the cells of the organ. Albumoses (but not peptone) and basic products are also formed. The autolysis differs in many important particulars from tryptic activity, particularly in selecting the globulin of the liver for destruction. The enzyme can be thrown down by ammonium sulphate, but more of this salt is needed than in the case of the liver aldehydase. The solutions obtained as the result of this autolytic activity are able to decompose solutions of hippuric acid with the formation of benzoic acid, and solutions of urea are decomposed also with the formation of ammonia, but whether this is due to the same or other enzymes is left an open question. The liver juice injected intravenously does not affect coagulation, but in a few experiments *in vitro* the coagulation of the blood was hindered, and in one case where coagulation took place 'fibrinolysis' occurred rapidly afterwards; boiling the juice did not affect this action. The autolytic decomposition of the liver is believed to occur *intra vitam* under conditions in which putrefaction is excluded, and increase in this normal function is stated to be the principal underlying pathological factor leading to the destruction of the liver substance and formation of leucine, tyrosine, ammonia, &c., in acute atrophy and phosphorus poisoning.

W. D. H.

Human Chyle. By THEODOR PANZER (*Zeit. physiol. Chem.*, 1900, 30, 113—116).—Owing to surgical interference, it became possible to obtain specimens of chyle from the thoracic duct of a woman.

It was alkaline, and became clear on shaking with ether. Microscopically, it showed fat particles and leucocytes. The proteids were albumin and traces of globulin, whilst albumoses, peptone, sugar, lecithin, urea, and uric acid were absent. Cholesterol, neutral fats, soaps, and a diastatic ferment were present. The inorganic salts were chiefly chlorides, sulphates, and phosphates of sodium and potassium. Four specimens were examined, and the main results are as follows:

Water	90.29 to 94.53 per cent.
Solids	5.47 " 9.71 "
Organic substances	4.53 " 8.91 "
Inorganic salts.....	0.8 " 1.04 "
Coagulable proteid	2.16, one determination only
Substances soluble in ether...	6.59 " " W. D. H."

Properties and Formation of Lymph. By LEON ASHER and WILLIAM J. GIES (*Zeit. Biol.*, 1900, 40, 180—216).—This is another contribution to the much discussed question whether lymph is formed by purely mechanical processes. After intravenous injection of sugar, quinine does not influence the quantity or composition or amount of sugar in the lymph. This does not exclude a 'physiological' factor in lymph formation, even although quinine is a capillary poison. The action of 'liver poisons' (Heidenhain's first class of lymphagogues) is inhibited by quinine. Liver activity is at least one 'physiological' factor, and quinine is known to lessen the action of this organ so far as its glycogenic and urea forming functions are concerned. The action of liver poisons cannot be simply explained as due to an increase of the permeability of the capillary walls in the liver. Arsenic is a typical 'capillary poison,' and leads to an increased flow of highly concentrated lymph. The injury to the vessel walls is much greater than that produced by crabs' muscle and leech extracts, still the formation of lymph is greater if these weaker reagents are used. These facts are emphasised when it is considered that the formation of lymph goes on for a short time *post-mortem*. This is analogous to what occurs in *post-mortem* formation of saliva, and is a proof that the two depend upon similar physiological processes.

W. D. H.

Excretion in the Small Intestine. By CYRIL CORLETT (*J. Physiol.*, 1900, 25, 344—355).—In a closed segment of ileum, a large mass accumulates, as originally shown by Hermann. The amount varies, and may depend on the amount of stimulation of the mucous membrane by bacterial products. Possibly some reabsorption occurs, and substances difficult of absorption like nuclein tend to accumulate. The mass contains iron, and calcium phosphate from the *débris* of shed cells; soaps are also present. More or less of the faecal pigment is derived from the shed bowel epithelium. None of the dogs experimented upon, five in number, exhibited any symptoms due to poisoning from bacterial products.

W. D. H.

Action of the Liquid of the External Prostate on the Liquid of the Vesiculæ Seminales. By L. CAMUS and EUGÈNE GLEY (*Compt. rend.*, 1900, 131, 351—353. Compare Abstr., 1899, ii, 779).—The secretion of Cowper's glands or of the external prostate of the hedgehog produces an agglutinating action on the formed elements of the liquid secreted by the *vesiculæ seminales* and also the precipitation of a proteid substance in the same fluid.

W. D. H.

Properties of the Secretion of the Internal Prostate of the Hedgehog. By L. CAMUS and EUGÈNE GLEY (*Compt. rend.*, 1900, 131, 353—355).—The secretion of the internal prostate has the same properties as that of the external prostate (see preceding abstract). In the case of the internal prostate, however, this does not depend on the presence of the substance named vesiculin. W. D. H.

Peculiarities in the Urine of Vegetarians. By JOHN H. LONG (*J. Amer. Chem. Soc.*, 1900, 22, 592—595. Compare this vol., ii, 580).—Results are quoted of the analyses of the urine of seven men who, for a year or longer, had lived wholly on a vegetarian diet. The average daily excretion for a vegetarian appears to be 874 c.c. as against 1167 c.c. for non-vegetarians. If due allowance be made for the difference in concentration between a normal and vegetarian urine, the most striking feature is the small amount of creatinine in the latter, and this probably points to low metabolism, the subjects of experiment taking but little exercise. The reducing power due to carbohydrates and similar substances is somewhat higher than in the case of a normal urine. J. J. S.

Estimation of Amino-acid Nitrogen in Urine. By MEINHARD PFAUNDLER (*Zeit. physiol. Chem.*, 1900, 30, 75—89).—The total nitrogen of the urine was estimated in four fractions: (1) The nitrogen in the substances precipitable by phosphotungstic acid, which can be split off by phosphoric acid. This includes that from ammonia, carbamic acid, and a part of that from the uric acid, purine bases, urine-mucoid, and other proteids of normal urine. (2) The nitrogen in the same precipitate which cannot be split off by phosphoric acid; this includes the remainder of that from substances like uric acid, of which only a part of the nitrogen is firmly combined, also that from diamines, diamino-acids, and ptomaines. (3) The nitrogen which is easily split off in the urine *minus* the phosphotungstic precipitate; this includes that from urea, allantoin, oxaluric acid, and a part of the creatinine. (4) The firmly combined nitrogen in the substances not precipitable by phosphotungstic acid. This includes that from amino-acids and their derivatives, hippuric acid, taurine and cystine compounds, and in pathological urines, leucine, tyrosine, &c. In this last fraction, oxyproteic acid comprises from 41 to 46 per cent. of the whole. In urine containing albumin and albumose, the first fraction is increased by the amino-nitrogen of the proteids, and the second by Hausmann's mono- and di-amino-nitrogen. In all cases the ammonia can be estimated separately by Schloesing's method. The following table summarises the results obtained. The most marked result seen is the rise, in phosphorus poisoning, of the fourth fraction (due to amino-acids) and in the ammonia, at the expense, presumably, of the urea:

	Fraction 1	2	3	4	Ammonia.
Normal human urine	8.34	6.65	80.14	4.88	—
Dog. 1 normal urine	7.67	5.10	84.97	2.26	4.33
during phosphorus poisoning	7.73	5.24	81.89	5.13	5.77
Dog. 2 normal urine	7.00	2.24	86.43	4.33	4.03
during phosphorus poisoning	7.13	2.10	83.76	7.01	5.59

W. D. H.

Loosely Combined Sulphur in the Urine. By EUGEN PETRY (*Zeit. physiol. Chem.*, 1900, 30, 45—60).—The so-called 'neutral sulphur' of the urine is an ill-characterised quantity and is combined in various compounds. An important and easily determinable fraction of this, however, is that which can be readily split off as a metallic sulphide. In the dog on a mixed diet, and on a diet of flesh only, its amount varies slightly, namely, from 1 to 3 per cent. of the total sulphur. By feeding with casein, a proteid relatively poor in sulphur, the percentage varies from 3 to 3·15; with serum-albumin and serum-globulin from 1·1 to 2·2; with hetero-albumose (which contains a high percentage of easily dissociable sulphur), 5·5. Feeding with asparagus shoots has no influence. In phosphorus poisoning, the amount is slightly raised; in cases of liver cirrhosis and leucæmia, little departure from the normal is noticeable. Acetonitrile raises the amount, the increase being due to formation of thiocyanogen. Differences noted between different animals cannot be explained by variations in their diet. W. D. H.

Pseudomucin from Ovarian Cysts. By ZÄNGERLE (*Chem. Centr.*, 1900, i, 1035; from *Münch. med. Woch.*, 47, 414—415).—The pseudomucin from ovarian fluid yielded glucosamine after decomposition with hydrochloric acid. The reducing substance is therefore identical with that obtained by F. Müller from sputum and the sub-maxillary gland, and by Seemann from ovomucoid. In all these cases, the glucoproteid is a product of secreting cells. W. D. H.

Acetone Glycosuria. By WALTER RUSCHHAUPT (*Chem. Centr.*, 1900, i, 1036—1037; from *Arch. exp. Path. Pharm.*, 44, 127—141).—Acetone is present in normal urine in small quantities. In diabetes mellitus, the amount is increased. By acetone poisoning, produced by breathing acetone vapour, or by intravenous or subcutaneous injection of acetone, or by feeding on acetone, artificial glycosuria is produced. The sugar is derived from the carbohydrate constituents of the body, for in starving animals in which the glycogen has been reduced to a minimum, the glycosuria produced is very slight. W. D. H.

Antihepatic Serum. By C. DELEZENNE (*Compt. rend.*, 1900, 131, 427—429).—Since the publication of Bordet's work (*Ann. Inst. Pasteur*, 1898—1900) on artificial hæmolytic serums, various observers have sought to prepare serums which act specifically on different groups of cells or organs. The present communication relates to a serum which acts injuriously on the liver cells. If an emulsion of dog's liver is injected intraperitoneally in rabbits and ducks, a serum is obtained from the blood of these animals which is strongly poisonous to the dog. If 2—4 c.c. of the serum are injected intraperitoneally or intravenously, death results, and the symptoms and *post-mortem* pathological appearances are almost exclusively of a hepatic nature. If death is rapid, the liver exhibits acute necrosis; if the animal lives a few days, the urea of the urine is lessened, and ammonia and amino-acids are increased; if carbohydrate food is given, there may be slight glycosuria; there is no

jaundice. After death, intense fatty degeneration of the liver cells is found. Small and gradually increasing doses of the serum create immunity; and the serum of an immunised animal has similar protective power.

W. D. H.

Syntheses in the Animal Organism. I. Piperidine Derivatives. By HERMANN HILDEBRANDT (*Chem. Centr.*, 1900, ii, 202—203; from *Arch. exp. Path. Pharm.*, 44, 278—316).—By the action of phenols and formaldehyde on piperidine, water is eliminated, and piperidides, which are usually crystalline compounds, are formed. "*Thymotinpiperidide*," $C_{16}H_{22}ON$, prepared from thymol, formaldehyde, and piperidine, melts at 149.5° . "*Carvacrylpiperidide*," similarly obtained from carvacrol, melts at 182° ; "*p-cresylpiperidide*" melts at 45° ; " *α -naphthylpiperidide*" and " *β -naphthylpiperidide*" melt at 135° and at 96° respectively.

The physiological action of thymotin-, carvacryl-, and *p*-cresylpiperidides on rabbits is, generally speaking, similar to that of piperidine. After administering thymotinpiperidide, the urine contains a glycuronic acid compound of "methylthymotinpiperidide"; it is a neutral crystalline substance, melts at 192° , and by boiling with hydrochloric acid yields a "methylthymotinpiperidide." Similar glycuronic acid compounds are obtained from other piperidides, and these substances are scarcely poisonous. By feeding with sucrose, dextrose, or maltose before administering the piperidide, its poisonous action is very much mitigated. Lævulose has a similar effect, but to a less extent, whilst lactose, galactose, dextrin, and mannitol are inactive in this respect; thus, it is only the sugars capable of forming glycogen in the organism which tend to form glycuronic acid compounds of these piperidides.

The physiological effects of the amide of tetramethylpyrrolinecarboxylic acid, its reduction product, and the methylamide of 1-methyltetramethylpyrrolinecarboxylic acid were also investigated.

E. W. W.

May Phenolphthalein be safely added to Marc-Wines? By ZOLTÁN VON VÁMOSSY (*Chem. Zeit.*, 1900, 24, 679—680).—The author's experiments were undertaken at the request of Liebermann, who wished to ascertain whether small quantities of phenolphthalein may be added, without any ill effect, to margarine and also to marc-wines to facilitate recognition. Experiments conducted first on rabbits, and afterwards on himself and a colleague, showed that a dose of 1—1.5 grams has no other effect than that produced by saline draughts or castor oil, whilst the long continued use of daily doses of 0.1 gram produced no unpleasant symptoms whatever.

Considering that 1 gram of phenolphthalein is sufficient for 100 litres of wine, the small quantity thus introduced into the system can do no possible harm, particularly as the bulk of the phenolphthalein passes through the system undecomposed.

L. DE K.

Physiological Action of Poehl's Spermine. By WALTER E. DIXON (*J. Physiol.*, 1900, 25, 356—363).—Spermine injected intravenously produces a temporary fall of blood pressure, which is partly

of cardiac origin and partly due to dilatation of the splanchnic blood-vessels. This result is not influenced by nicotine or by section of the vagi. Atropine cuts out the fall of pressure without influencing the splanchnic dilatation. The spleen is constricted; the testis is dilated; the renal vessels follow the blood-pressure passively. Spermine and choline are about equally toxic, and the similarity in their action is extremely striking. W. D. H.

Physiological Action of the Poisonous Secretion of the Gila Monster. By JOHN VAN DEUBURG and OTIS B. WIGHT (*Amer. J. Physiol.*, 1900, 4, 209—308).—A full account is given of experiments on dogs, cats, and frogs for the purpose of ascertaining the exact action on the various organs and functions of the body produced by the poison of the Gila Monster (*Heloderma suspectum*). The effects differ in no important respect from those of various snake venoms. No chemical examination of the poison itself is given.

W. D. H.

Iodine in Corals. By LAFAYETTE B. MENDEL (*Amer. J. Physiol.*, 1900, 4, 243—246).—Drechsel showed that the horny axial skeleton of the *Gorgonia cavolinii* contains iodine in organic combination. Several other workers have shown the same to be true for certain sponges and other marine organisms, and commented on the importance of iodine metabolism in certain animals. The present research shows the same is true for three other corals. The iodine apparently does not enter into the constitution of the true growing part of the animal. The following quantitative results are given; Drechsel's figures are added for comparison.

	Iodine.	Chlorine.
<i>G. cavolinii</i> (Drechsel)	7.79 per cent.	2.18 per cent.
<i>G. acerosa</i>	1.70 "	3.17 "
<i>G. flabellum</i>	1.15 "	1.24 "
<i>Plexora flexuosa</i>	0.28 "	0.86 "

W. D. H.

Colouring Matter of Echinus Esculentus. By ARTHUR B. GRIFFITHS (*Compt. rend.*, 1900, 131, 421—422).—The amorphous violet pigment of *Echinus esculentus* has the composition $C_{16}H_{12}ON_2$; when boiled with concentrated mineral acids, it yields leucine and formic acid.

W. A. D.

Chemistry of Vegetable Physiology and Agriculture.

Bacteriolysis of the Bacillus Anthracis. By G. MALFITANO (*Compt. rend.*, 1900, 131, 295—298).—Living protoplasm is believed to be capable of forming enzymes which ultimately destroy the protoplasm of the cells which produce them. Thus spontaneous destruction of bacteria (auto-bacteriolysis) is a possibility due to the production of a proteolytic enzyme by the bacteria. The experiments recorded

are stated to confirm this as a fact in the case of the *Bacillus anthracis*. Bacteriolysis occurs best in a neutral medium, and certain antiseptics are believed to owe their efficacy, not to their power of destroying protoplasm or counteracting enzymic action, but to the fact that, by altering the reaction of the medium, they allow spontaneous bacteriolysis to occur more readily.

W. D. H.

Gas Producing Power of *Bacillus Coli Communis* under Different Conditions of Environment. By MARY E. PENNINGTON and GEORGE C. KÜSEL (*J. Amer. Chem. Soc.*, 1900, 22, 556—567).—Cultures of this organism made on nutrient agar are most active, so far as gas production is concerned, when three days old, if kept at a temperature of 37°; older cultures produce less gas. The gas evolved under ordinary conditions consists of hydrogen 62—70, carbon dioxide 23—34, methane 1—4, and nitrogen 1—5 per cent. When grown in an apparatus from which oxygen is excluded, methane is not formed, and when grown in a medium free from meat extract, the amount of nitrogen evolved does not diminish.

There appears to be an intimate relationship between the reducing power which liberates hydrogen and that which produces nitrogen, but carbon dioxide is formed in largest quantity at the outset.

An apparatus consisting of two glass bulbs, one provided with a stopcock and attached to the other by rubber tubing, is recommended for experimental work of this kind.

J. J. S.

Physiology of Yeast. By ÉMILE DUCLAUX (*Chem. Centr.*, 1900, ii, 54—55; from *Allg. Hopf. Brauerz.*, 1900, 933).—A résumé and discussion of the physiological relationships of the yeast cell.

E. W. W.

Chemical Fermentation by Yeast in an Antiseptic Medium. By JOSEPH DE REY-PAILHADE (*Bull. Soc. Chim.*, 1900, [iii], 23, 666—668).—When brewer's yeast is quickly pressed and digested with a solution of maltose containing 1—1.2 per cent. of sodium fluoride, little action at first takes place, but after the third day a considerable evolution of carbon dioxide is noticed, and proteid substances are found to have entered into solution. In the first stage, the yeast is gradually destroyed by the antiseptic, whilst the later stage of more active change is due to the purely chemical action of ferments derived from the yeast. The evolution of gas is almost immediately arrested by the addition of sulphur, a fact which suggests that the ferments in question are closely related to philothion or hydrogenase (compare Abstr., 1899, i, 180).

N. L.

Germination. By LÉON MAQUENNE (*Ann. Agron.*, 1900, 26, 321—332).—The results of the author's experiments indicate that the predominating, if not the only, rôle in the conservation and development of seeds must be attributed to the diastases, and that the causes which retard the alteration of the diastases tend to maintain the germinating power of the seeds. When preserved under conditions, of which absence of moisture is the most important, favourable to the diastases remaining inactive, seeds may be kept indefinitely.

N. H. J. M.

Influence of Pressure on Chlorophyllous Assimilation. By JEAN FRIEDEL (*Compt. rend.*, 1900, 131, 477—479).—Experiments made with various plants in an atmosphere containing 10 per cent. by volume of carbon dioxide and at pressures between 1·0 and 0·25 atmosphere, show that within these limits the nature of chlorophyllous assimilation is not altered, and the quotient O_2/CO_2 remains practically unity. The intensity of the assimilation, however, diminishes regularly with the pressure. C. H. B.

Ashes of some Medicinal Plants. By ARTHUR B. GRIFFITHS (*Compt. rend.*, 1900, 131, 422—423).—Full analyses are given of the ash of sarsaparilla, hydrastis, cardamom, oak, rhatany, and belladonna; manganese is present in all these plants. W. A. D.

Phosphorus Compound first formed in Chlorophyllous Plants. Physiological Rôle of Inositol. By POSTERNAK (*Ann. Agron.*, 1900, 26, 362—265; from *Rev. gén. bot.*, 12, 5 and 12).—The results of experiments with seeds of *Picea excelsa* showed that a relatively small amount of the phosphorus is contained in the proteids, the greater part being in the filtrates from the proteids. Several organic compounds rich in phosphorus were obtained from the solutions.

One of these compounds, "oxymethylphosphoric acid," CH_3O_3P , forms brilliant tablets and is very hygroscopic. Its composition indicates that it is an additive compound of phosphoric acid and formaldehyde, and its production is a direct proof that carbon dioxide is converted into formaldehyde before being utilised in the production of plastic matters. When its barium salt is distilled during 5 or 6 hours with 40 per cent. acid, there is no production of formaldehyde, but an almost pure solution of inositol is obtained.

It is suggested that inositol may be formed in plants when formaldehyde is produced in excess; whilst the glucose formed at the same time is capable of being directly assimilated, inositol would be a reserve substance, retaining the excess of formaldehyde in a convenient form so as to be at the disposal of the cells if required. N. H. J. M.

Citric Acid in Saturation-Sludge. By KARL ANDERLEK (*Zeit. Zuckerind. Böhm.*, 1900, 24, 645—648).—Besides oxalic acid, the sludge was found to contain citric acid (0·16 to 1·21 per cent. in the dry matter), and a small amount of what is probably tricarballic acid.

Michaelis detected citric acid in beet-root juice in 1851 (*J. pr. Chem.*, 54, 184; compare also C. Schrader, *Annalen*, 1862, 121, 370).

N. H. J. M.

Presence of Vanillin in Vanilla. By JOHANNES BEHRENS (*Bied. Centr.*, 1900, 29, 547—549; from *D. Tropenpflanzer*, 1899, 299).—The fact that ripe vanilla has no odour may be due to the odour of vanillin being retained by the living protoplasm, or, as is more probable, the production of vanillin may only occur after the death of the fruit-cells. It was found that fresh leaves, or an extract of the leaves, acquire a distinct odour of vanillin when heated with dilute sulphuric or hydrochloric acid for 2 hours at 100°. The leaves contain, therefore, a soluble substance having the properties of a vanilla-glucoside. In the

natural treatment of the fruit, the breaking up into vanillin and sugar would be brought about by an enzyme. N. H. J. M.

Nitrogenous Substances in Malt. By PAUL PETIT and G. LABOUBASSE (*Compt. rend.*, 1900, 131, 394—396).—The authors denote the nitrogen precipitated with phosphotungstic acid and with zinc sulphate by *A* and *B* respectively, and that present in the ammonia evolved on boiling with dilute hydrochloric acid for 2 hours, by *C*; the nitrogen *A* is probably that of peptones, *B* that of albumoses, and *C* that of aminic substances. After adding hops and boiling for 2½ hours the nitrogen *A* and *C* of the malt, when water containing a small quantity of calcium sulphate is used, is partly changed into the form *B*; when sodium chloride is present in the water instead, the tendency is for *A* to change into *C*, *B* remaining constant; whilst with calcium hydrogen carbonate the change is less marked, *A* being formed at the expense of *B* and *C*. Saccharification is thus largely influenced by the nature of the mineral matter in the water employed. During fermentation, relatively small amounts of *C* are assimilated by the yeast, except in the presence of sodium chloride, when the proportion of *C* removed is large and that of *A* practically *nil*; the proportions of *A* and *B* absorbed, especially the latter, are large in all cases. W. A. D.

Milky Juice of Hura Crepitans. By J. J. SURIE (*Chem. Centr.*, 1900, i, 1210—1211; from *Ned. Tijds. Pharm.*, 12, 107—116).—The milky juice of *Hura crepitans* is an acid liquid of sp. gr. 1·05—1·06; it has a lingering, burning taste, and causes violent inflammation and swelling of the skin. The poisonous constituent, *hurin*, may be extracted by ether; it is volatile in steam, has a faint acid reaction, melts at 23°, and even in the form of vapour causes inflammation and eczema. E. W. W.

Analyses of Marine Algæ. By L. CUNIASSE (*Chem. Centr.*, 1900, ii, 286—287; from *Ann. Chim. anal. Appl.*, 5, 213—215).—The aqueous extract of 100—200 grams of ash is evaporated to dryness, and the residue distilled with manganese dioxide and sulphuric acid, the vapours being absorbed in aqueous caustic alkali. Iodine is precipitated with palladium nitrate, bromine and chlorine with silver nitrate.

The ash of the richer varieties of sea algæ contain, Br, 0·192—0·423; I, 0·602—1·408; Na₂O, 8·13—26·50, and K₂O, 8·70—23·03 per cent.; that of the poorer kinds, Br, 0·039—0·161; I, 0·070—0·157; Na₂O, 8·50—16·25, and K₂O, 10·80—18·20 per cent. L. DE K.

Experiments at Grignon. By PIERRE P. DEHÉRAIN (*Ann. Agron.*, 1900, 26, 369—383. Compare this vol., ii, 303).—Field experiments with varieties of potatoes, and smaller experiments on the effect on potatoes of green manuring with vetches are described.

Mangolds. The object of these experiments, which were made in large boxes of 4 cubic m. capacity was to ascertain the effect of irrigation on the growth of mangolds. No. 1 was manured with vetches and was not watered; No. 2 had no green manure, but was watered; and No. 3 was manured with vetches and was watered. The yield of dry matter, sugar, and nitrogen was considerably greater in 2 than in 1;

in 3 rather more dry matter and nitrogen and rather less sugar were obtained than in 2. The results apply only to a good soil resting on an impermeable and inclined subsoil.

Sainfoin and Lucerne. When sainfoin and lucerne are sown together at Grignon, the sainfoin predominates during the first two years, and then disappears. In 1897, several plots were sown with the mixed seed; no manure was applied. In 1899, gramineous herbage appeared on the plots, and a variety of manures were applied. The manures had very little effect on the yield, but whilst the herbage from the sodium nitrate plot contained 18.5 per cent. of *Gramineæ*, the hay manured with potash and superphosphate contained only 15.5 per cent. In 1900, there was so much inferior grass that the experiment was discontinued.

It is thought possible that the failure may be due to the vigorous growth of sainfoin having weakened the lucerne, and rendered it incapable of resisting the encroachment of the grasses, but it is also possible that leguminous crops have been grown too long.

N. H. J. M.

Value of Molasses as Food. By PAUL HOPPE (*Zeit. Ver. Deut. Zuckerind.*, 1900, 535, 713—762).—It is of importance to ascertain the nature of the molasses employed as food; acid molasses should be rejected.

In experiments with cows, it was found that large amounts of molasses, 5 kilos. per day, did not interfere with digestion, and had no purgative action. It is thought that the purging sometimes observed by others is not only, or mainly, due to the salts present in the molasses, but to the saccharates.

In the cases of cows recently calved, molasses acted only on the production of milk; during gestation, however, molasses was favourable both as regards milk production and in increasing the live weight.

Whilst molasses increased the yield of milk, the percentage of fat was distinctly diminished when large amounts of molasses were employed; the percentage of nitrogen remained unaltered, and the acidity was increased. Molasses had no effect on the butter.

Dried molasses is preferable to liquid molasses, and forms a good substitute for mangolds. The dried substance is not only very favourable to milk production, but also increases the live weight.

N. H. J. M.

Blood Molasses. By FRIEDRICH STROHMER (*Chem. Centr.*, 1900, ii, 135—136; from *Oesterr.-ung. Zeit. Zucker-Ind. Landw.*, 29, 161—172).—The food is prepared by drying and sterilising a mixture of blood (4 parts) and molasses (1 part) with bran or brewers' grains. According to Maercker, 95.9 per cent. of the proteids is digestible. Satisfactory results of feeding experiments with blood molasses were obtained by Ramm and Mintrop (*Milch-Zeit.*, 27, 519, and this vol., ii, 39) and by Lilienthal (this vol., ii, 502).

As regards the amount of blood available, it is stated that the Vienna slaughter-houses furnished 6,000,000 kilos. in one year.

N. H. J. M.

Feeding Pigs with Blood Molasses. By LILIENTHAL (*Bied. Centr.*, 1900, 29, 526—527; from *Deut. Landw. Presse*, 1899, 74; compare this vol., ii, 502).—The results of experiments with pigs showed that there was at first an increase in weight due to feeding with blood molasses, but that finally the weights were considerably less than with maize and barley (in addition to skim-milk and roots). The molasses did not interfere with the health of the pigs, but injured the quality of the meat; the fat was watery, and some of it of a spongy texture.

It is thought that it may be possible to prepare a food suitable for pigs from blood molasses. N. H. J. M.

Peat-meal Molasses. By RUDOLF Woy (*Chem. Centr.*, 1900, ii, 284; from *Zeit. öffent. Chem.*, 6, 201—204).—Whilst peat-meal shows a slightly acid reaction, the addition of alkaline molasses renders it strongly acid, without, however, affecting essentially the amount of alkali required to neutralise it. During prolonged storage, the sugar becomes inverted by the acid of the peat unless this is rendered neutral.

The amount of sugar present is determined as follows. The food (16.5 grams) is extracted on a funnel with boiling water, the solution treated with lead acetate when cold, and diluted to 300 c.c. Two hundred c.c. of the filtered solution are freed from lead by means of sodium phosphate solution (20 c.c.), and 50 c.c. inverted by heating for 20 minutes in water heated to 67—70° with 5 c.c. of 20 per cent. hydrochloric acid. The inverted solution is then diluted to 250 c.c., of which 50 c.c. is employed for determining the sugar by Kjeldahl's method. The invert sugar (in cg. from Kjeldahl's tables) doubled and multiplied by 0.95 gives the percentage of cane sugar in the food. Assuming the molasses to contain 48 per cent. of cane sugar, the relation of peat to molasses can be ascertained sufficiently exactly.

In the above method, the raffinose will be included in the results as cane sugar. This is, however, of no practical importance, as raffinose is presumably as readily digested as cane sugar.

A polarimetric method for determining the sugar is described, but as a rule the gravimetric method is preferable. N. H. J. M.

Feeding Experiments with Crushed Palm Kernels. By PAUL VIETH (*Chem. Centr.*, 1900, ii, 136—137; from *Milch. Zeit.*, 1900, 294—295).—Six cows were fed with straw, hay, chaff, dried brewers' grains (1000 grams), rape cake (250 grams), peat molasses (500 grams), maize gluten meal (250 grams), and stored beetroot sections (20 kilograms) per head per day. In addition, the cows received either crushed palm kernels (2 kilos.) or cotton-seed meal (0.5) and wheat bean (1.5 kilograms). Although the palm kernels gave only slightly better results as regards the yield of milk, fat, and total dry matter, its employment is strongly recommended owing to its less cost.

N. H. J. M.

Composition of Various Kinds of Peat. By BRUNO TACKE and BERNHARD TOLLENS (*Bied. Centr.*, 1900, 29, 508—509; from *J. Landw.*, 1898, 46, 341. Compare H. von Feilitzen, *ibid.*, 46, 9).—The

samples of peat were of German, Hungarian, and Russian origin, and contained from 54.5 to 57 per cent. of carbon, with the exception of one which contained 64.32 per cent. (in the substance free from ash). The amounts of ash, organic matter, carbon, hydrogen, nitrogen, and oxygen in all the samples are given. The percentage of nitrogen in organic matter varied from 3.96 to 6.86 per cent. N. H. J. M.

Composition of Drainage from Unmanured and Manured Peat Soil, with special reference to Nitrogen Compounds. By BRUNO TACKE, HEINRICH IMMENDORFF, and H. MINNSEN (*Bied. Centr.*, 1900, 29, 505—508; from *Landw. Jahrb.*, 1898, *Erg.-bd.*, iv, 349).—The peaty soil, contained in pots, was manured with lime, and with lime, kainite, and basic slag both with and without addition of sodium nitrate; there were also check experiments without manure.

It was found that a portion of the organic nitrogenous matter of peat is readily decomposed, with production of ammonia and nitrates; most of the nitrogenous matter is, however, very stable, and its decomposition is not promoted by the normal amount of lime as this does not completely neutralise the acidity of the soil. Large amounts of lime promote nitrification considerably. Manuring with lime, kainite, and phosphate does not appreciably increase the amount of ammonia in the drainage, but there was a distinct increase in ammonia when sodium nitrate was applied in addition to the mineral manures.

Both the pre-existing phosphoric acid and that applied as manure are retained by peat with considerable tenacity, but when phosphates are applied continuously the retentive power of the soil seems to diminish.

With regard to potash, magnesia, and lime, small portions of these constituents present in natural peat-land are relatively readily soluble in water; the greater portion is, however, sparingly soluble. Much of the potash applied as manure is liable to loss in drainage, whilst the rest is retained by the soil.

Manuring with potash increases the solubility of the lime very considerably. N. H. J. M.

Changes in the Weights of Artificial Manures when Exposed to Air. By L. VON WISSELL (*Chem. Centr.*, 1900, ii, 282—283; from *J. Landw.*, 48, 116—121).—Fifty grams of each manure were exposed to the air in flat dishes covered with perforated paper. Basic slag changed very little, notwithstanding the free lime which it contains, the maximum gain being 0.6 per cent. Superphosphate showed, according to the temperature and condition of the atmosphere, the maximum loss and gain of -3.7 and +9.3 per cent. Kainite and sodium nitrate lost in weight in warm, dry weather, but in damp air the weight increased by as much as 31 and 11.1 per cent. respectively. One sample of ammonium sulphate gained 5 per cent. in weight, whilst a second sample was only slightly hygroscopic.

N. H. J. M.

Manurial Experiments with Green and Dead Plants and Parts of Plants. By EWALD WOLLNY (*Bied. Centr.*, 1900, 29, 509—523; from *Vierteljahresschr. Bay. Landw.-rat.*, 1897, Heft. 3 and 4).—In the case of soils poor in humus and nitrogen, green manuring

with leguminous plants, supplemented with potash, phosphates, and lime, is far more effective than when non-leguminous plants are employed. On highly nitrogenous soils, the effect of manuring with leguminous plants is the same as with non-leguminous. The ploughing in of plants on the land where they were grown is less effective than when the crop is removed to fallow land. Manuring with straw had a relatively slight effect. Pea and bean straw gave, on the whole, better results than rye and rape straw.

The application of peat was, as a rule, very beneficial. Sandy soil, when manured with peat, retained more water, whilst loam was rendered more porous.

Experiments are described in which winter rye was grown on plots from which the residues of the previous crops had been removed, and on plots containing the residues. The results showed that the removal of the crop residues diminished the yield. The most valuable crop residues are those of clovers, then those of root-crops and potatoes, and last, the stubble and roots of cereals.

N. H. J. M.

Influence of Bacteria on the Decomposition of Bones. By JULIUS STOKLASA, F. DUCHÁČEK, and J. PITRA (*Zeit. Zuckerind. Böhm.*, 1900, 24, 627—645).—Sifted bone meal (in quantities of 10 grams) with water (900 c.c.), potassium sulphate (0.1 gram), magnesium chloride (0.05 gram), and ferric sulphate (0.01 gram) was sterilised, and then inoculated with various bacteria. The following percentage amounts of nitrogen in different forms, and of dissolved phosphoric acid (per cent. of total) were found at the end of the experiment, which lasted 33 days.

	Amide nitrogen.	Diamine nitrogen.	Monamine nitrogen.	P ₂ O ₅ , in solution.
Not inoculated.....	4.33	28.72	61.51	3.83
<i>Bacillus megatherium</i> (alinit) ...	61.04	20.48	14.05	21.56
„ <i>fluorescens liquefaciens</i>	22.60	56.80	15.40	9.19
„ <i>proteus vulgaris</i>	43.57	29.62	28.54	14.79
„ <i>butyricus</i> , Hueppe.....	45.85	14.42	35.57	15.55
„ <i>mycoides</i>	62.15	8.62	25.05	23.03
„ <i>mesentericus vulgatus</i> ...	63.05	40.96	—	20.60

Vegetation experiments are described in which oats grown in large pots were manured with bone meal and inoculated with the different bacteria. Dextrose was applied to the inoculated pots. The results accord with those described above. In the case of *B. megatherium*, one pot was without dextrose. Whilst in this case the yield of oats was far greater than without inoculation, the addition of dextrose gave rise to a further increase. Xylose, in the place of dextrose, produced a still greater increase in the pot inoculated with *B. megatherium*.

The soil employed for these experiments was not sterilised before being inoculated.

N. H. J. M.

Infected Phosphates. By HUGO BORNTÄGKE (*Chem. Centr.*, 1900, ii, 283; from *Oesterr. Chem. Zeit.*, 3, 235).—A sample of ammonium phosphate acquired an intense odour of putrid urine, whilst potassium phosphate became covered with red and blue algae. As superphosphates

may become similarly infected, it is proposed to add to them free humic acid, from peat, or else Cassel brown or lignite. In this manner, both infection and the production of insoluble phosphoric acid would be prevented.

N. H. J. M.

Analytical Chemistry.

Employment of Floats in Burettes. By KREITLING (*Zeit. angew. Chem.*, 1900, 829—836).—A lengthy investigation as to the use of floats in burettes. The results are given in tabular form. The conclusion reached is that their use should be avoided.

L. DE K.

[**Electrometric Estimation of Iodine**]. By F. CROGINO (*Zeit. anorg. Chem.*, 1900, 24, 225—262).—See this vol., ii, 642.

Detection of Iodic Acid in the Presence of Chloric Acid, Bromic Acid, Perchloric Acid, and Periodic Acid by means of Morphine Sulphate. By C. REICHARD (*Chem. Zeit.*, 1900, 24, 644—646).—Potassium iodate may be recognised in the presence of potassium bromate and perchlorate by adding some morphine sulphate and a little sulphuric acid, when a brown precipitate, or according to the amount of dilution, a brown, yellowish-brown, or yellow coloration is produced; the reaction may be obtained at still greater dilutions by adding some ammonia at the beginning of the reaction, but the coloration then takes some time to develop. If potassium periodate is present, it may be isolated by treating the mixture with a little cold water, in which it is practically insoluble. Potassium periodate also gives a similar but less marked reaction with morphine sulphate.

The reaction is interfered with by the presence of arsenious and sulphurous acids.

L. DE K.

Apparatus for the Determination of Ammonia in Water by the Wanklyn Method, and Total Nitrogen by the Kjeldahl Method. By ROBERT SPURR WESTON (*J. Amer. Chem. Soc.*, 1900, 22, 468—473).—A detailed description of a modified form of distillation apparatus suitable for cases where a large number of estimations are carried on at the same time. The point aimed at is that the distilling flasks, burners, and receivers are all at the front of the apparatus and so readily accessible. For details, the drawings in the original must be consulted.

E. G.

Comparative Estimations of Nitrogen in Saltpetre. By L. VON WISSEL (*Chem. Centr.*, 1900, ii, 212; from *J. Landw.*, 48, 105—115).—The author has investigated Möckern's process (reduction of nitrates with zinc and iron powder in an alkaline solution), Ulsch's process (reduction with reduced iron and sulphuric acid), Forster's process (reduction with sulphosalicylic acid and sodium thiosulphate), and Devarda's process (reduction with aluminium-zinc-copper).

The last is, in the author's opinion, the most accurate and rapid ; the following proportions are recommended : 50 c.c. of the solution of nitrate (0.5 gram solid), 120—145 c.c. of water, 7.5—9 c.c. of alcohol, 75—90 c.c. of aqueous potassium hydroxide (sp. gr. 1.3) or 75 c.c. of aqueous sodium hydroxide (sp. gr. 1.34) and 3.5—4.5 grams of aluminium-copper-zinc alloy.

L. DE K.

Gasometric Method of Estimating Nitrites in Presence of Nitrates or other Soluble Salts. By J. GAILHAT (*J. Pharm.*, 1900, [vi], 12, 9—12).—All air is initially expelled by boiling from the flask of a Schlössing's apparatus for estimating nitrates, two-thirds filled with concentrated aqueous ammonium chloride ; 10 c.c. of the solution to be titrated, containing from 5—10 grams of nitrite per litre, are then gradually added, and the nitrogen evolved quantitatively according to the equation $\text{NH}_4\text{Cl} + \text{M}'\text{NO}_2 = \text{N}_2 + 2\text{H}_2\text{O} + \text{M}'\text{Cl}$, measured in a graduated tube completely immersed in cold water. Experiments are cited showing the degree of accuracy of the method.

W. A. D.

Iodometric Estimation of Arsenic Acid. By FRANK A. GOOCH and JULIA C. MORRIS (*Amer. J. Sci.*, 1900, 10, 151—157).—Williamson's process, namely, liberating iodine by adding potassium iodide and a sufficiency of hydrochloric acid to a weak solution of the arsenate and titrating with sodium thiosulphate, suffers from some sources of error. Owing to the large amount of acid, there is a danger of iodine being liberated from the potassium iodide by the action of the air and the acid may also cause partial decomposition of the thiosulphate ; these two errors somewhat compensate one another. Then again, starch cannot be used as indicator in the presence of strong acid. After being bleached, the liquid may be neutralised with potassium carbonate (not hydroxide), excess of potassium hydrogen carbonate added, and the arsenious acid titrated as usual with iodine. When using Williamson's process, it must be remembered that should there be a deficiency of acid the reaction becomes reversible.

Although the authors have proved by a series of experiments that the process may be improved by deducting 0.0030 gram of arsenic acid when using the direct titration with thiosulphate, and 0.0015 gram when titrating the alkaline liquid with iodine, they still prefer the method proposed by Gooch and Browning (*Abstr.*, 1891, 244). In this process, the arsenic acid is reduced by boiling with dilute sulphuric acid and potassium iodide, the last trace of free iodine is bleached with sulphurous acid, and the cold and neutralised liquid is then titrated as usual with standard iodine.

L. DE K.

Process for the Estimation of Carbon Dioxide in Carbonates. By R. E. DIVINE (*J. Amer. Chem. Soc.*, 1900, 22, 473—476).—An account is given of a simple and accurate method in which the carbon dioxide is liberated by means of sulphuric or tartaric acid and absorbed by solution of barium hydroxide, the excess of which is determined by titration with standard hydrochloric acid. The apparatus is fully described with the aid of a diagram.

E. G.

Detection of Metals by the Absorption Spectra of their Compounds with Alkanna. By JULIUS FORMÁNEK (*Zeit. anal. Chem.*, 1900, 39, 409—434).—The neutral chlorides and nitrates of the following metals give more or less characteristic absorption spectra with an alcoholic extract of alkanna root, to which a trace of ammonia is added: iron, caesium, potassium, rubidium, sodium, cobalt, barium, strontium, lithium, nickel, manganese, calcium, magnesium, zinc, copper, and aluminium; and without addition of ammonia: iron, uranium, nickel, copper, aluminium, and beryllium. The remaining metals produce no alteration of the alkanna spectrum. A single flint glass prism of 60° should be used in order that the spectrum may not be too much extended.

The extract of alkanna root with 95 per cent. alcohol should be of such concentration that its own absorption bands are well defined. To 5 c.c. of this extract, in a test-tube of 10—12 mm. diameter, a few drops of the metallic solution are added, and after observing the spectrum, a trace of dilute ammonia, but not enough to produce a precipitate, is added. In the case of the alkali metals, the bands disappear after a time; those of the alkaline earths gradually shift towards the red; with aluminium, the development of the bands requires time. When two metals are present, it sometimes happens that the bands peculiar to each are not simultaneously present, but new bands of intermediate position are produced. In other cases, the presence of one metal will completely suppress the spectrum due to another.

M. J. S.

Estimation of Total and Free Alkali and Alkali Carbonate in Soaps. By ROBERT HENRIQUES and OTTO MAYER (*Zeit. angew. Chem.*, 1900, 785—788).—Five to ten grams of soap are dissolved in 100 c.c. of water contained in an Erlenmeyer flask. When cold, the flask is closed with a treble-perforated cork through the centre of which passes a separating funnel; through one of the other holes passes a bent tube reaching to the bottom of the flask and connected at the other end with a wash bottle containing aqueous sodium hydroxide, and through the third hole passes a bent tube connected with a drying bottle containing sulphuric acid, a tube containing calcium chloride and a weighed potash bulb apparatus; the last is then connected with an aspirator.

A known volume of $N/2$ hydrochloric acid is introduced into the flask, the funnel is slightly rinsed, and the aspirator is set in action. Gentle heat is now applied so that the soap is fully decomposed in about half or three-quarters of an hour, and the air current is then kept up for about another hour when the bulb-apparatus is weighed. From the carbon dioxide thus found, the amount of alkali carbonate is calculated.

The liquid in the flask is heated, and the fatty acids are filtered off and washed with boiling water until free from acidity; the filtrate is then titrated with $N/2$ alkali. The fatty acids are dissolved in boiling alcohol, the filter is thoroughly washed, and the filtrate also titrated with $N/2$, preferably alcoholic, alkali; as a check, the solution may be evaporated to dryness and the pure soap weighed. From these results, the amounts of total and free alkali are readily calculated. The process

becomes a little more complicated when the fats employed in the manufacture of the soap contain soluble fatty acids. In this case, the total fatty acids of the sample must be estimated by decomposing the soap with dilute hydrochloric acid in the presence of ether. After carefully washing the ethereal solution with a little cold water, it is titrated with $N/2$ alcoholic alkali. L. DE K.

Method for the Rapid Gravimetric Estimation of Calcium. By WILLIAM H. HESS (*J. Amer. Chem. Soc.*, 1900, 22, 477—478).—The following method for the estimation of calcium, in which it is weighed as sulphate, is both rapid and accurate. Calcium oxalate is precipitated in the usual way and ignited; the residue of lime is treated with about its own bulk of dry ammonium nitrate and about twice as much fused ammonium sulphate, and gradually heated until fumes of ammonium salts cease to be driven off. By this means, the whole of the lime is converted into calcium sulphate. E. G.

Titration of Zinc with Potassium Ferrocyanide. By EDMUND H. MILLER and E. J. HALL (*Chem. Centr.*, 1900, ii, 146—147; from *School of Mines Quarterly*, 21, 267—272).—When titrating zinc in hydrochloric acid solution with potassium ferrocyanide, using uranium acetate as indicator, the liquid should not contain calcium chloride or aluminium sulphate; magnesium sulphate, although interfering with the titration in an ammoniacal solution, does not affect it in an acid liquid. Traces of lead do not interfere, provided there is a sufficiency of free acid, but it has been found that a large excess of acid is in itself a source of error. Ammonium chloride should also be absent, as it dissolves some zinc ferrocyanide. Traces of bismuth do not interfere, but antimonious chloride does so appreciably. L. DE K.

Electrolytic Estimation of Cadmium. By DMITRI BALACHOWSKI (*Compt. rend.*, 1900, 131, 384—387).—All previously described methods of precipitating cadmium electrolytically are too slow and give a too loosely adherent deposit to be of use in analysis; the necessary details are now given for the quantitative deposition of the metal. Aqueous solutions of the sulphate are used containing either acetic acid, urea, formaldehyde, or acetaldehyde. W. A. D.

Action of Sodium Thiosulphate on Lead Salts. By FRANZ FAKTOR (*Chem. Centr.*, 1900, ii, 239—240; from *Pharm. Post*, 33, 355).—A boiling concentrated solution of sodium thiosulphate added to a boiling solution of lead nitrate produces a white precipitate which does not become black on prolonged boiling. When the lead has been converted into chloride by means of sodium chloride, the precipitate becomes partly converted into sulphide on prolonged heating. If, however, ammonium chloride is used instead of the sodium salt, sodium thiosulphate produces at once a precipitate of heavy, black lead sulphide. L. DE K.

Analyses of Lead and Tin Ores, also of the most important Lead and Tin Preparations and their Commercial Products. By H. MENNICKE (*Chem. Centr.*, 1900, ii, 287—288; from *Zeit. öffentl. Chem.*, 6, 190—194, 204—213).—The author treats the lead or tin

compound with hot, dilute hydrochloric acid and metallic zinc, best in the presence of platinum. The metallic lead is washed with dilute hydrochloric acid, then with alcohol, and after being dried in a current of coal gas, is weighed. The metallic tin may be weighed as such, or it may be redissolved in strong hydrochloric acid in a current of carbon dioxide, and titrated with the usual precautions with potassium permanganate. About 2 milligrams of metallic tin escape the action of the zinc and should be allowed for.

L. DE K.

Analysis of Phosphor-copper. By HUGO BORNTÄGER (*Zeit. anal. Chem.*, 1900, 39, 360).—Half a gram of the substance is dissolved in 10 c.c. of nitric acid of sp. gr. 1.4, the solution is made strongly alkaline with ammonia, and filtered from carbon, ferric oxide, and silica. The copper in the filtrate is thrown down by ammonium sulphide and ignited by Rose's method. In the filtrate from the copper sulphide, the phosphoric acid is precipitated by magnesia mixture after concentrating.

M. J. S.

Titration of Mercury by Sodium Thiosulphate. By JOHN T. NORTON, jun. (*Amer. J. Sci.*, 1900, 10, 48—54).—Scherer has proposed a process for the volumetric estimation of mercurous nitrate, mercuric nitrate, or mercuric chloride by direct titration with sodium thiosulphate without the aid of an indicator. The author states that the process breaks down with mercurous or mercuric nitrates, but, with a slight modification, accurate results may be obtained with mercuric chloride when the amount of this does not exceed 0.1 gram.

The solution is placed in a litre flask, diluted to 100 c.c., and heated to 60°. *N/20* solution of sodium thiosulphate is now added from a burette until the white precipitate turns slightly brown. The liquid is diluted with cold water, a little asbestos fibre added, and the whole well shaken and poured on to an asbestos filter placed on a perforated platinum cone which is fixed in a glass funnel by means of a rubber connection; the funnel passes through the stopper of a large, side-necked Erlenmeyer flask connected with an exhaust pump. After carefully washing the precipitate, the filtrate is mixed with 3 grams of potassium iodide, and the excess of thiosulphate estimated as usual by means of *N/20* iodine. One c.c. of *N/20* sodium thiosulphate represents 0.015 gram of metallic mercury.

L. DE K.

Simple and Accurate Method for the Estimation of Mercury in Urine. By P. FARUP (*Chem. Centr.*, 1900, ii, 213—214; from *Arch. exp. Path. Pharm.*, 44, 272—277).—About 1 litre of urine is mixed with 3—4 c.c. of hydrochloric acid, heated in a water-bath to 70—80°, and shaken for 2 minutes with 6 grams of zinc dust. When cold, this is collected on a filter of silky asbestos. This is then put back into the flask and treated with hydrochloric acid and potassium chlorate. In this solution, the mercury is precipitated by stannous chloride, collected on gold-asbestos, and weighed.

L. DE K.

Estimation of Mercury in Urine. By J. WERDER (*Zeit. anal. Chem.*, 1900, 39, 358—359).—The method published by Schumacher and Jung (this vol., ii, 247) is incomplete, inasmuch as no confirmation is furnished that the loss of weight suffered by the gold asbestos

when ignited is really due to the presence of mercury. This proof can be supplied by connecting the asbestos filter tube containing the amalgamated gold with a bulb tube through which a current of air is aspirated. The connection is made by a plug of asbestos, and, by suitably heating, the mercury expelled is collected in the bulb, where it can be identified by aspirating over it the vapour of iodine which converts it into the red iodide.

M. J. S.

Examination of Aluminium and Zinc by Solution in Hydrochloric Acid. By F. BALDY (*Chem. Centr.*, 1900, ii, 238—239; from *Ann. Chim. anal. appl.*, 5, 201—205).—The metal (0.5—1 gram) is placed in a flask with 40 c.c. of water, and then dissolved by adding 10 c.c. of a mixture of 4 volumes of hydrochloric acid of sp. gr. 1.02 with 1 volume of nitric acid of sp. gr. 1.334. The gases evolved, after passing through a condenser, are freed from hydrochloric acid by means of ferrous sulphate, the carbon dioxide then absorbed by means of calcium succinate and estimated by titration. The metals are precipitated from a portion of the acid solution by sodium hydroxide and in the filtrate the sulphuric acid is estimated, whilst another portion of the solution is used for the estimation of phosphorus and arsenic.

The aluminium is separated from the iron by potassium hydroxide and determined as phosphate. In the case of zinc, the iron and lead are precipitated by ammonia, and the zinc and cadmium separated by potassium hydroxide.

E. W. W.

Volumetric Estimation of Manganese in Pig-iron, Cast-iron, and Steel. By ANDRÉ MIGNOT (*Chem. Centr.*, 1900, ii, 65—66; from *Ann. Chim. anal. appl.*, 5, 172—177).—The sample is dissolved in 25 times its weight of nitric acid of sp. gr. 1.2, heated to boiling, diluted with water and mixed with three times its weight of bismuth tetroxide. The pink solution is then filtered through asbestos, and the permanganic acid titrated with hydrogen peroxide. The process is not applicable in the presence of chromium if this exceeds 1 per cent.

Bismuth tetroxide is prepared by fusing in an iron dish equal parts of bismuth subnitrate and potassium chlorate with 2 parts of sodium hydroxide; the mass is then extracted with water to remove the alkali and dried.

L. DE K.

Precipitation of the Sulphides of Nickel and Cobalt in an Alkaline Tartrate Solution. By OLIN F. TOWER (*J. Amer. Chem. Soc.*, 1900, 22, 501—521).—In employing the method suggested by Villiers (*Abstr.*, 1895, ii, 228, 247) for the qualitative separation of nickel and cobalt, it is found that the oxidation of the solution to which the hydrogen sulphide has been added results in the separation of so much sulphur that, if nickel is present and cobalt absent, the black solution will colour the sulphur, making it very difficult to distinguish it from precipitated cobalt sulphide; it is also observed that the sodium chloride present in the solution may cause some nickel sulphide to be precipitated which may be easily mistaken for cobalt sulphide. Experiments are described which show that nickel sulphide in solution in an alkaline tartrate is in the colloidal state.

E. G.

Action of Sodium Thiosulphate on Certain Metallic Salts, and its Employment in Quantitative Analysis. By FRANZ FAKTOR (*Zeit. anal. Chem.*, 1900, 39, 345—354).—Under certain conditions, sodium thiosulphate can be used for the estimation of the chromium in chromates and chromic salts. From a solution of potassium chromate or dichromate, to which ammonium chloride or magnesium chloride is added, the whole of the chromium is precipitated as chromium chromate (mixed with sulphur) by boiling with an excess of sodium thiosulphate. The precipitate is converted into pure chromic oxide by ignition. From chromic chloride, the whole of the chromium is not precipitated unless a small quantity of a chromate is also present.

Lead chloride or lead nitrate mixed with ammonium chloride (but not if sodium chloride is substituted) readily yields the whole of its lead as sulphide when heated with an excess of thiosulphate. Silver nitrate also yields all its silver as sulphide when warmed with sodium thiosulphate. Nickel and cobalt yield sulphides, but the precipitation is in neither case complete. M. J. S.

Volumetric Estimation of Chromic Acid by Arsenious Acid in an Alkaline Solution. By C. REICHARD (*Chem. Zeit.*, 1900, 24, 563—564).—A known weight of pure arsenious oxide is dissolved in 10 per cent. aqueous sodium hydroxide and the exact strength of the solution is ascertained by titrating with either standard iodine or standard permanganate.

The chromate to be analysed is boiled for some time with a known volume of the alkaline arsenious oxide solution; this causes the separation of some of the chromium hydroxide, which is removed by filtration through a sieve-like porcelain funnel. The filtrate is then nearly neutralised with dilute hydrochloric acid, excess of sodium hydrogen carbonate is added, and the excess of arsenious acid estimated as usual by means of iodine.

To avoid the filtration, the liquid may be mixed with excess of dilute sulphuric acid, any undissolved chromium hydroxide washed by decantation, and the excess of arsenious acid titrated with standard potassium permanganate. The test-analyses are satisfactory.

L. DE K.

Estimation of Molybdenum in Iron. By E. DÖHLER (*Chem. Zeit.*, 1900, 24, 537).—The sample is dissolved in nitric acid and the solution evaporated to dryness to render silica insoluble. The mass is then treated with strong hydrochloric acid and boiled down to a small volume. After diluting with water and filtering, the liquid is heated to 80° and saturated with hydrogen sulphide; after 12 hours, the precipitate is collected, well washed with water containing hydrogen sulphide and a few drops of hydrochloric acid, and then digested with ammonium sulphide. Any insoluble matter is freed from traces of molybdenum by fusing it in a porcelain crucible with sodium potassium carbonate and sulphur; the mass is treated with water and the filtrate added to the ammonium sulphide solution. The liquid is now heated and acidified with hydrochloric acid, which causes the precipitation of molybdenum sulphide and free sulphur. The pre-

precipitate is collected on a weighed filter, thoroughly washed with hot water, dried at 120°, and weighed. The mass is then detached from the filter, well mixed in an agate mortar, and an aliquot part is placed in a weighed boat and heated in a current of hydrogen; the molybdenum disulphide so obtained is then weighed

L. DE K.

Rapid Assay of Tungsten Ores and Residues. By HUGO BORNTÄGER (*Zeit. anal. Chem.*, 1900, 39, 361—362).—Wolframite, the most common tungsten ore, contains as impurities sand, calcium, magnesium, antimony, arsenic, tin, lead, cobalt, nickel, copper, and traces of gold, with occasionally molybdenite. A gram of the finely powdered mineral is fused for an hour with 10 grams of sodium carbonate, the mass exhausted with water, and the residue ignited and weighed. By deducting this residue from 100, the percentage of tungstic acid is obtained within 5 per cent., which for rough assays is sufficiently close. For more accurate work, the aqueous extract is made up to 250 c.c., and 100 c.c. is delivered into a mixture of 15 c.c. of concentrated nitric acid and 45 c.c. of concentrated hydrochloric acid. The mixture is evaporated to dryness and extracted with a liquid containing 100 grams of ammonium chloride, 100 grams of strong hydrochloric acid, and 1000 grams of water. The insoluble matter, which contains the tungstic acid with silica and stannic oxide, is dissolved in ammonia, the solution poured into a similar acid mixture, and this liquid evaporated to dryness. The residue, washed as before, is ignited and weighed as tungstic acid. Metallic tungsten and its alloys with copper, iron, nickel, &c., should be roasted for half an hour before fusing as above, and a little nitre added to the soda.

M. J. S.

Action of Sodium Thiosulphate on Bismuthic, Ferrous, and Ferric Salts. By FRANZ FAKTOR (*Chem. Centr.*, 1900, ii, 20—21, 67; from *Pharm. Post*, 33, 301, 317).—Neutral aqueous solutions of bismuthic salts are quantitatively precipitated as trisulphide by sodium thiosulphate (? on boiling). To obtain trustworthy results in estimating bismuth by this method, the trisulphide should be moderately ignited in a current of hydrogen sulphide.

Neutral solutions of ferric salts are first coloured violet by sodium thiosulphate, but gradually assume a yellow or brownish-yellow colour, which is not altered on prolonged boiling. If, however, a little ammonia is added, a greenish-black precipitate is formed, which on continued boiling yields blackish-brown, granular, ferrous hydroxide (? ferrosiferic hydroxide). The precipitation does not seem to be complete.

Solutions of ferrous salts are not precipitated on boiling with sodium thiosulphate unless ammonium chloride and ammonia are added. The iron then gradually separates as sulphide.

L. DE K.

Electrolytic Precipitation of Antimony from its Sulpho-salt with the Application of a Diaphragm. By HERMANN OST and W. KLAPPROTH (*Zeit. angew. Chem.*, 1900, 827—829).—The authors have made an attempt to improve the electrolytic method

for the estimation of antimony by the introduction of a diaphragm in order to prevent the solution of the metal in the accumulating polysulphide.

The apparatus was composed of a Classen's platinum dish in which was suspended a basin-like diaphragm made of porous porcelain; a platinum disc in the diaphragm cell was made the anode, and the dish the cathode, and both dishes were covered with cut-out watch glasses. The experiments were made with a solution of "Schlippe's salt" containing 0.0985 gram of antimony per 10 c.c., and a solution of pure sodium sulphide containing 195 grams of this salt, equal to 200 grams of pure sodium hydroxide per litre; 10 c.c. of the antimony solution were mixed with varying amounts of sodium sulphide and then diluted to 125 c.c.

When the antimony is introduced in both anode and cathode, it is only completely precipitated in the latter; if introduced in the latter only, it is completely removed from the liquid. If introduced in the anode only, not a trace of metal is deposited at the cathode, but antimony sulphide is formed at the anode.

The completeness of the precipitation in the cathode depends slightly on the amount of sodium sulphide. If this is present in excess and when, consequently, the tension is low, all the antimony is precipitated, but in the presence of but little sodium sulphide and a high tension, a small portion of the antimony passes through the diaphragm, and is precipitated as sulphide on the anode. The metal, however, never passes from the anode to the cathode.

The other products of the electrolysis, both in the anode and cathode space, were investigated with the aid of Wehrlin's decomposition cell. The gas collecting in the cathode was proved to consist of practically pure hydrogen. At the anode, oxygen is formed, but this rarely escapes as gas, as it is at once absorbed by the sodium sulphide, forming sodium polysulphide and sodium thiosulphate.

It remains to be seen whether the use of the diaphragm is to be recommended. It presents no difficulties with antimony alone, but in the presence of tin the tension should not exceed 1 volt.

L. DE K.

Improved Absorption Apparatus for Use in the Analysis of Essential Oils. By ALFRED C. CHAPMAN and HERBERT E. BURGESS (*Analyst*, 1900, 25, 197—199).—The apparatus consists of a 250 c.c. flask with a long, narrow neck and a tubulure at the bottom through which passes a bent glass tube connected by a long piece of india-rubber to a funnel. Communication between these may be closed or established by means of a pinch-cock.

Twenty-five c.c. of the essential oil are introduced into the flask, the temperature being carefully noted. After adding a sufficiency of the absorbent, the mixture is thoroughly shaken, and the aqueous layer removed by opening the pinch-cock. A fresh quantity of absorbent may now be added, or the residual oil may be washed with either hot or cold water.

To the flask is now attached a ground, specially-constructed measuring

tube, the character of which depends on particular circumstances ; it may be surrounded by a water jacket. By pouring water into the funnel and raising the india-rubber tubing, the oil is forced from the flask into the graduated tube, where its volume is then read off at the original temperature.

L. DE K.

Estimation of *m*-Cresol in Mixtures of Cresols. By FRITZ RASCHIG (*Zeit. angew. Chem.*, 1900, 759—761).—Ten grams of the sample are weighed in a small Erlenmeyer flask and mixed with 15 c.c. of sulphuric acid of sp. gr. 1.846. After being heated for an hour at 95—100°, the contents are poured into a wide-necked litre flask and rapidly cooled under a tap with circular motion to spread the compound over the sides of the flask. The Erlenmeyer flask is now quickly rinsed with 90 c.c. of nitric acid of sp. gr. 1.385, and this is poured all at once into the litre flask ; the whole is thoroughly shaken for not more than 20 seconds and then put into a fume chamber. After the lapse of about 1 minute, a violent action sets in with evolution of red fumes ; the clear liquid becomes turbid, oily drops of trinitro-*m*-cresol collect at the bottom, and after 5 minutes the reaction seems to be completed. After waiting 5 minutes longer, the liquid is emptied into a dish containing 40 c.c. of water and the flask is rinsed with another 40 c.c. The trinitro-*m*-cresol now solidifies to a crystalline mass, which after two hours is collected on a counterpoised filter, dried at 95—100°, and weighed. Its weight divided by 1.74 equals the amount of *m*-cresol.

The process is not applicable in the presence of large quantities of phenol.

L. DE K.

Estimation of Glycerol in Fats and Soaps. By FERDINAND JEAN (*Chem. Centr.*, 1900, ii, 293 ; from *Ann. Chim. anal. appl.*, 5, 211—213).—The author has applied Laborde's process for the estimation of glycerol, based on the isolation of its carbon by means of sulphuric acid (*Abstr.*, 1899, ii, 816), to the analysis of fats and soaps.

Ten grams of saponified fat or soap are dissolved in hot water and precipitated with zinc sulphate. The solution is mixed with 10 drops of sulphuric acid, evaporated to 2—3 c.c., and then treated with 6 c.c. of strong sulphuric acid at 150° as directed.

L. DE K.

Analysis of Saccharine Liquids. By GEORGES HALPHEN (*J. Pharm.*, 1900, [vi], 12, 12—14).—In Raczkowski's method of examining saccharine liquids (*Mon. Sci.*, 1896, 19), the potassium carbonate used for removing the excess of lead acetate gives rise to decomposition products of dextrin, which render the solution ultimately obtained highly absorptive of light, and thus unsuitable for polarimetric examination ; the author obviates this by using calcium instead of potassium carbonate, and slightly modifying the original procedure in a few other particulars.

W. A. D.

Estimation of Sugar in Beet. By JOHANN KOVÁČ (*Chem. Centr.*, 1900, ii, 148—149 ; from *Oesterr.-ung. Zeit. Zucker-Ind.*, 29, 182—209).—Three processes are in general use for the extraction

of beet for polariscopic purposes, namely, extraction with alcohol, digestion with hot alcohol of 85 per cent., and digestion with hot water.

As the result of many years' experience, the author thinks the alcoholic extraction process is the best, as fewer impurities pass into the solution.

L. DE K.

[Estimation of Sugar in] Peat-meal Molasses. By RUDOLF WOI (*Chem. Centr.*, 1900, ii, 284; from *Zeit. öffentl. Chem.*, 6, 201—204).—See this vol. ii, 682.

Polarimetric Estimation of Sugar in Wine. By XAVIER ROCQUES (*Chem. Centr.*, 1900, ii, 291; from *Ann. Chim. anal. appl.*, 5, 216—219).—When polarising wine, it is necessary to first remove the alcohol, as this rapidly diminishes the rotatory power of lævulose and slightly that of dextrose; sucrose is not affected.

Formulæ are given for calculating the amount of dextrose (x) and lævulose (y) in a litre of liquid, using the polarisation (R) in circular degrees, and the gravimetric estimation of the total reducing sugars (P).

$$x = (R + mP)/(0.106 + m), \quad y = P - x.$$

$m = a_D l/v$, in which a_D is the specific rotatory of lævulose with due regard to temperature, $l = 2$ the length of the polarising tube, $v = 1000$ the volume of the liquid; m at 10° has the value 0.1916, at 15° 0.1860, at 20° 0.1748, and at 25° 0.1692.

L. DE K.

Detection of Salicylic Acid in the Presence of Citric Acid. By OTTO LANGKOPF (*Chem. Centr.*, 1900, ii, 147—148; from *Pharm. Centr. H.*, 41, 335—337).—Salicylic acid cannot be detected in lemon juice by adding ferric chloride, as the citric acid interferes with the reaction. It may, however, be readily isolated by shaking the sample with a mixture of equal volumes of ether and light petroleum; ether alone should not be used as it slightly dissolves citric acid.

L. DE K.

A Cause of Error in Testing for Salicylic Acid in Wines. By ANTONIO J. FERREIRA DA SILVA (*Compt. rend.*, 1900, 131, 423—424).—The Petlet-Grobert method is unsatisfactory since, with samples of pure wine, it often gives a rose or reddish-violet coloration liable to be confused with that produced by salicylic acid; the German official test, however, is always trustworthy.

W. A. D.

Estimation of Uric Acid. By A. BELLOCQ (*J. Pharm.*, 1900, [vi], 12, 103—104).—To 200 c.c. of urine are added 20 c.c. of a mixture of 30 c.c. of a 1:3 solution of zinc sulphate, 30 c.c. of aqueous sodium hydroxide, and 40 c.c. of a saturated solution of sodium carbonate; complete precipitation usually occurs, a perfectly limpid liquid being obtained, but should this not happen, more of the reagent is added. The precipitate is collected, and, after draining, is easily transferred to a crucible, floating on water; 2 or 3 c.c. of hydrochloric acid saturated with uric acid are added, when crystals of uric acid rapidly separate. These are collected in a small cylindrical funnel on a wad of moistened absorbent cotton, washed with 10 c.c. of alcohol,

a second wad of cotton pressed down, and the whole transferred to a filter paper, dried, and weighed.

W. A. D.

Precipitation of Uric Acid by Barium Chloride. By ADOLF JOLLES (*Zeit. anal. Chem.*, 1900, 39, 355—357).—It was stated by Geelmuyden (*Abstr.*, 1892, 1032) that the precipitation of uric acid by barium chloride can be employed for its estimation in urine. The author admits that with pure uric acid the precipitation is fairly complete, but shows that from neutralised urine only a small fraction of the uric acid present is thrown down, whilst the precipitate contains other nitrogenous substances which Geelmuyden has mistaken for uric acid, since he confined himself to estimating the total nitrogen in the precipitate without identifying the nature of the nitrogenous substance precipitated.

M. J. S.

Composition of Milk and Milk Products. By HENRY DROOP RICHMOND (*Analyst*, 1900, 25, 225—231).—The paper contains the report on the composition of milk and allied products analysed in the laboratory of the Aylesbury Dairy Co. in 1899.

With a very few exceptions, the samples were in every respect above the legal standard; in the case of those samples which fell below 8.5 per cent. of solids not fat, it was again proved that the deficiency was solely due to lactose, and not to casein or ash.

Timpe's formula for calculating the amount of added water or of abstraction of cream, which is based on the supposed relation between proteids and fat (this vol., ii, 251), is stated to be untrustworthy and unsuitable for commercial milk-analysis.

The colour tests with *p*-phenylenediamine or *m*-phenylenediamine and amyl alcohol, proposed to distinguish between raw and heated milk, should not be implicitly depended on, and Faber's albumin test should always be applied as a check.

Analyses of butter and cream are also given; a butter prepared by an extractor supposed to increase the yield contained 20.42 per cent. of water.

L. DE K.

Umikoff's Reaction with Human Milk. By NADINA SIRBER (*Zeit. physiol. Chem.*, 1900, 30, 101—112).—Umikoff (*Trudy Wratsch. Petersburg vospitatei*, 1898) has described a reaction by which human milk can be distinguished from the milk of the cow and other vegetable feeders. If 5 c.c. of the milk are mixed with 2.5 c.c. of 10 per cent. aqueous ammonia, and the mixture kept at 60° for 15—20 minutes, a violet-red coloration is obtained. As lactation progresses, the intensity of the reaction is increased. These statements are confirmed. The substance is dialysable, and the dialysate of cow's milk gives it. The substance which gives the reaction is not lactose, as Marchetti supposed, but citric acid. Although cow's milk contains more citric acid, it also contains more calcium salts, which hinder the reaction; the dialysate contains more citric acid than calcium salts, and so gives the reaction.

W. D. H.

Composition of Danish Butter. By HARALD FABER (*Analyst*, 1900, 25, 199—201).—The samples, the analysis of which is recorded in a table, were duplicates of those taken by the Custom House offi-

cials at the port of importation every month during 1898 and 1899. The tests were limited to the determination of the Reichert-Wollny figure, the refraction in Zeiss's instrument at 45°, and the Bechi test for cotton-seed oil (margarine).

On the whole, the samples had a very high Reichert-Wollny number; in a few samples during the autumn this fell to 24.3—25.6. It has now been proved beyond dispute that the use of cotton-seed cake as cattle food may cause the butter to give a decided Bechi test, so that this does not necessarily imply any addition of margarine.

A table is given showing the average amount of water during the years 1890—1898; the highest percentage recorded is 17—18.

L. DE K.

Welmans' Phosphomolybdate Test. By P. WELMANS (*Chem. Centr.*, 1900, i, 1248—1249; from *Zeit. öffentl. Chem.*, 6, 127—134, 143—148).—This is a reply to several critics who, in the author's opinion, have not consulted his original instructions.

The reagent is prepared by dissolving 20 grams of sodium phosphomolybdate in water containing 10 c.c. of 25 per cent. nitric acid, and diluting to 100 c.c. This solution should show no sign of green, and must become perfectly colourless on adding excess of ammonia. When added to pure lard, no reduction takes place, but if the sample should contain vegetable oils in sound condition a green colour is noticed. This green is really a mixture of a blue colour with the yellow colour of the reagent, and when the reduction has been very decided, the blue colour predominates. If there has been so little reduction that no green coloration is noticed, a trace of blue may be obtained by adding excess of ammonia, but no notice should be taken of such a slight reduction. The author has already stated that the reduction is undoubtedly caused by the colouring matters contained in the oils, which may be of a glucoside-like nature.

Soltsien's statement (compare following abstract), that phosphomolybdic acid even in ammoniacal solution is reduced by aldehydes, is challenged. No doubt there are a number of substances capable of reducing the reagent, but these are not likely to be met with in practice.

L. DE K.

Welmans' Reaction for the Detection of Vegetable Oils. By PAUL SOLTSIEN (*Chem. Centr.*, 1900, ii, 289; from *Zeit. öffentl. Chem.*, 6, 187—190).—The colour produced on adding Welmans' reagent (preceding abstract) to a vegetable oil should be noticed after 5 minutes, as after some time all oils give the reaction. The author prefers to avoid the use of chloroform, and therefore melts the sample at a low temperature, and then adds a little of the reagent. After shaking for 5 minutes, excess of ammonia is added and the first change in colour noticed.

Butter-fat and horse-fat also give the reaction. The reagent is also reduced by furfuraldehyde and formaldehyde.

L. DE K.

Chemistry of Corn Oil [Maize Oil]. By HERMANN T. VULTE and HARRIET WINFIELD GIBSON (*J. Amer. Chem. Soc.*, 1900, 22, 453—467).—The physical and chemical constants of three samples of corn oil were

determined; (a) was a freshly prepared specimen of undoubted purity, (b) a commercial specimen, 6—7 years old, and (c) a product of the mash of distilleries, of a brown colour, and 10—12 years old. The results are summarised in the following tables:

Physical Constants.

	a.	b.	c.	Insoluble fat acids.
Specific gravity { 15.5°	0.9213	0.9213	0.9255	—
100°	0.8711	0.8716	0.8756	0.8529
Viscosity { water (20°)	10.57	9.79	—	—
rape oil (20°)	73.89	70.42	—	—
Index of refraction { 15°	1.4766	1.4767	—	—
20°	—	1.4761	1.4765	—
Melting-point	—	—	—	22.4°

Chemical Constants.

	a.	b.	c.	Insoluble fat acids
Ash (per cent.)	—	0.065	0.0655	—
Acid value	2.25	3.70	20.65	—
Free acid (as oleic acid, per cent.) ..	1.128	1.851	10.386	—
Degrees of acidity	4.00	6.59	36.83	—
Iodine absorption (per cent.)	118.62	119.74	113.27	120.98
Koettstorfer number	192.64	192.65	191.78	199.15
Saponification equivalent	291.22	291.21	292.55	281.72
Ether value	190.39	188.95	171.13	—
Hehner value	92.23	92.79	88.21	—
Reichert number	4.2	4.3	9.9	—
Weight of potassium hydroxide per 100 grams of oil	0.94248	0.96492	2.22156	—
Koettstorfer number of acetic oil.	211.9	211.5	—	—
Acetyl value	11.49	11.12	—	—
Glycerol (per cent.)	10.35	10.545	—	—
Unsaponifiable matter (per cent.) ..	1.43	1.39	—	—
Maumené { rise in temp.	74°	75°	—	—
specific temp.	176.2	178.6	—	—
Bromine thermal value	21.8°	21.9°	—	21.6°
Valenta's test	80°	74°	65°	—
Livache test (gain per cent.)	5.19	5.97	—	—
	in 10 days	in 7 days		

These observations are in each case compared with those of previous workers. The results of the application of a number of colour reactions to each sample of oil are also described. E. G.

Halphen's Colour Reaction for the Identification of Cotton Seed Oil. By P. N. RAIKOW (*Chem. Zeit.*, 1900, 24, 562—563, 583—585).—It has been proved that the active principle contained in cotton seed oil which causes the Halphen sulphur reaction is not the same substance as that which gives the Bechi silver test, as when cotton seed oil is thoroughly oxidised with potassium permanganate in the presence of cold dilute sulphuric acid, the resulting product still gives the Bechi, but no longer the Halphen, test.

Exposure of the mixture of cotton seed oil and Halphen's reagent (carbon disulphide, sulphur, and amyl alcohol) to sunlight has the same effect as heating; the colour obtained is permanent in the dark but gradually fades on prolonged exposure to light. This is not caused by the action of sunlight on the active principle itself, as cotton seed oil without any admixture of either carbon disulphide

or sulphur, after being exposed to the action of sunlight for 7 months, still gives both Bechi's and Halphen's reactions.

The conclusion finally drawn is that perhaps the active principle is an unknown unsaturated fatty acid with a side chain.

L. DE K.

Sesamé Oil. By F. UTZ (*Chem. Centr.*, 1900, ii, 293—294; from *Pharm. Zig.*, 45, 490—491).—The author has tested African, Indian, and Levantine sesamé oil, and tabulated the results. The analysis was restricted to the sp. gr., melting point of the fatty acids, polarisation in 20 cm. tube at 15°, iodine number (Hübl-Waller), refraction of the oils at 25° and 40°, and refraction of the fatty acids at 25° and 40°; the results show that the oil has a fairly constant composition.

Colour reactions were also tried. When shaken with hydrochloric acid (Bishop's test), this turns green, the colour being strongest with Indian and weakest with Levantine oil. The latter emulsifies with the acid, and only separates when heated in the water-bath; the supernatant oil assumes a dark orange colour. The other oils do not form an emulsion with the acid, and do not darken so much. Baudouin's test (hydrochloric acid and furfuraldehyde) shows best with the African oil.

The most delicate reaction, however, is Soltsien's stannous chloride test, which allows the detection of 0.5 per cent. of sesamé oil in earth-nut oil. The author also confirms the results obtained by Breinl (*Abstr.*, 1899, ii, 824) as regards the substitution of other aldehydes for furfuraldehyde.

L. DE K.

Polarimetric Estimation of Camphor in Camphorated Oil. By NORMAN LEONARD and HARRY M. SMITH (*Analyst*, 1900, 25, 202—203).—The authors have examined solutions of camphor in olive oil and its substitutes in the 200 mm. tube of a Schmidt and Haensch half-shadow polariscope, using sodium light, and find that the angular rotation is raised 1° for every per cent. of camphor. As the rotation of the oil is insignificant, it follows that the polariscope is a most convenient instrument for rapidly testing the strength of the officinal camphorated oil.

The results obtained practically confirm those of Chabot (*Abstr.*, 1890, 1427) and also those of Dowzard, who stated that the angular rotation per 100 mm. multiplied by 1.962 equals the percentage of camphor. The presence of the latter does not interfere with the identification of the oil by the refractometer. L. DE K.

Influence of Dextrose on the Estimation of Urea by the Hypobromite Method. By LÉON GARNIER and LÉOPOLD MICHEL (*J. Pharm.*, 1900, [vi], 12, 53—61).—The authors justify Jacoby's statement (*Abstr.*, 1886, 104) that the addition of dextrose in the hypobromite method enhances the production of nitrogen without, however, enabling the urea to yield its full complement of gas. The dextrose is, indeed, disadvantageous, since its energetic oxidation develops heat, necessitating a delay in reading the volume of the gas, and since a small quantity of carbon dioxide is produced with the nitrogen unless a large excess of alkali be used. Moreover, the augmentation of the yield of nitrogen is not only small but indeterminate.

Quinquaud's claim (*De l'urée*, 1897, 143) to have obtained theoretical results by means of a specially concentrated hypobromite solution without employing dextrose, is shown to be fallacious; but the comparative method of estimating urea in urine as described by Yvon and by Vieillard (*Analyse des urines*) yields perfectly satisfactory results.

W. A. D.

NOTE BY ABTRACTOR.—The foregoing experiments were made with 2 per cent. solutions of urea, whereas Moreigne, in a paper apparently overlooked by the author (*Abstr.*, 1899, ii, 73), has stated that with solutions containing more than 0.5 gram in 100 c.c., an error as great as 2.5—3.0 per cent. may arise.

Detection of Foreign Colouring Matters in Preserved Tomatoes. By GEORGES HALPHEN (*Chem. Centr.*, 1900, ii, 68; from *Ann. Chim. anal. appl.*, 5, 177—179).—**Coal-tar Colours.**—The substance is mixed with sand or silica and dried; the dry mass is moistened with glacial acetic acid and then shaken with twice its volume of 90 per cent. alcohol. The filtrate is diluted with 10 times its volume of water, and boiled for 15 minutes with washed silk. If coal-tar colours are present, the silk fibres become red or rose, but if absent they only turn yellowish or brownish.

Cochineal.—The dry mass is drenched with hydrochloric acid, and after 10 minutes shaken with twice its bulk of alcohol. The filtrate is diluted with 10 vols. of water and shaken with so much amyl alcohol that about 5 c.c. of the latter collect on the surface; the aqueous layer is then drawn off. To the amyl alcohol are added 1.5 vols. of carbon disulphide and 4—5 vols. of water, and after slight shaking the bottom layer is drawn off and the aqueous top layer is filtered. In the presence of cochineal, the filtrate is more or less yellowish-red, but becomes colourless when shaken with amyl alcohol; the latter then turns green when shaken with a solution of neutral uranium acetate.

L. DE K.

[**Urinary Indican.**] By JACOB BOUMA (*Zeit. physiol. Chem.*, 1900, 30, 117—125).—Many objections are urged against the method adopted by Wang for the estimation of urinary indican.

W. D. H.

Detection of Urobilin in Urine. By TH. ROMAN and G. DELLUC (*J. Pharm.*, 1900, [vi], 12, 49—50).—The advantage of rapidity is claimed for the following method of detecting urobilin. Eight to ten drops of pure hydrochloric acid and 20 c.c. of chloroform are added to 100 c.c. of urine, and, after carefully agitating, 2 c.c. of the chloroform solution are withdrawn; 4 c.c. of a solution of 1 gram of zinc chloride in 1 litre of alcohol of 95° are then added, without mixing, when the characteristic green ring appears between the two layers. On shaking, the liquid becomes rose-coloured, and shows a green fluorescence. Certain commercial alcohols, to which no zinc salt has been added, give, with the chloroform solution, the same reaction; this is due to their having dissolved traces of zinc during manufacture or storage.

W. A. D.

General and Physical Chemistry.

Spectra of Hydrogen and of Aqueous Vapour. By JOHN TROWBRIDGE (*Phil. Mag.*, 1900, [v], 50, 338—347).—Two spectra are attributed to hydrogen, the four-line spectrum, and the “white” spectrum consisting of a great number of lines. The author has studied the spectra with very powerful condenser discharges, employing a battery of twenty thousand Planté cells, and is of the opinion that the “white” spectrum only is a true hydrogen spectrum, and that the four-line spectrum is due to water vapour. In spite of all precautions to ensure dryness of the gas in glass vessels, it cannot be considered as dry when a condenser discharge is passed, since aqueous vapour is liberated from the glass, and with the powerful discharges employed essentially the same spectrum is obtained with hydrogen, rarefied air, or nitrogen. Aqueous vapour is therefore considered to be present in the solar atmosphere. Conclusions regarding the pressure and temperature of hydrogen in stars deduced from laboratory experiments in glass vessels are misleading, since conditions of electrical dissociation, aqueous vapour, &c., affect the nature of the spectrum more than pressure and temperature. L. M. J.

Influence of Slight Impurity on the Spectrum of a Gas. II. By PERCIVAL LEWIS (*Ann. Phys.*, 1900, [iv], 2, 447—458. Compare this vol., ii, 1).—The influence of a trace of mercury vapour on the spectrum of hydrogen has again been determined, this time with internal electrodes of iron; the intensity of the hydrogen lines is considerably diminished. The spectrum of nitrogen mixed with a trace of mercury, oxygen, or water vapour has been examined, and found to be less intense than that of the pure gas. The intensity of the bands in pure nitrogen reaches a maximum at a pressure of 3.5 mm. Sulphur and iodine vapour are without influence on the intensity of the nitrogen bands. The author considers that in spectroscopic investigations more account should be taken of the influence of slight impurity. J. C. P.

Lamps for Spectra. I. By ERNST BECKMANN (*Zeit. physikal. Chem.*, 1900, 34, 593—611).—The author, after discussing the various methods of colouring non-luminous flames, describes an apparatus whereby a fine spray of the colouring substance may be introduced into a flame. The tube of a burner is divided into two branches, which are bent round so that the outlets face each other. Below the point where the two jets meet, there is placed a small vessel containing a solution of the substance under examination. In this solution there is a spray-producer, consisting of a closed porous porcelain tube. This tube, which is connected with a reservoir of compressed air, allows a fine stream of the air to pass through and carry with it enough of the solution to impart a steady colour to the flame above. The permeability of the porcelain tube is increased, and the flame

colour rendered more intense, by impregnating the former with alcohol or some other organic liquid. J. C. P.

Fluorescence and Afterglow accompanying an Electric Discharge in Nitrogen. By PERCIVAL LEWIS (*Ann. Phys.*, 1900, [iv], 2, 459—468).—These phenomena are fully described by the author, and attributed to minute traces of oxygen present in the nitrogen. This oxygen probably is liberated by the discharge from a small quantity of water vapour persistently held by the glass. When the discharge tube is dried by heating sodium in it, neither fluorescence nor afterglow is observed. J. C. P.

Phosphorescence of Inorganic Substances. By EUGEN GOLDSTEIN (*Sitzungsber. K. Preuss. Akad. Wiss.*, 1900, 818—828).—Phosphorescence can be very advantageously detected by means of a form of apparatus in which the powdered substance falls from end to end of an exhausted tube, and is illuminated by cathode rays at one part of it; phosphorescent substances show a streak of coloured light, whilst other substances are only luminous in the path of the rays. The irregular results which have been usually obtained are due to impurities; salts of Li, Na, K, Rb, Cs, Ca, Sr, Ba, Al, Zr, Mg, Be, Zn, and Cd, which for the most part form colourless oxides, all show a blue to violet fluorescence, but minute traces of Cu, Cr, Mn, U, Ni, Co, Pb, Ce, La, Y, Er, Pr, or Nd suffice to produce a strong fluorescence which often entirely masks the blue fluorescence of the pure substance. T. M. L.

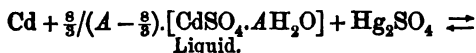
Action on Photographic Plates of Minerals containing Uranium and Thorium. By AFANASSÉEFF (*J. Russ. Phys. Chem. Soc.*, 1900, 32, ii, 103—106).—Fifty-one minerals were examined with regard to their power of emitting rays capable of affecting a photographic plate. In general, the presence in a mineral of a large percentage of uranium or thorium corresponds with a relatively intense photographic action. The fact that laranskite, which contains no uranium or thorium, produces an impression on a photographic plate, is explained by the presence in it either of some other mineral containing one of these metals or of a new element. T. H. P.

Meta-stable Character of the Weston Cadmium Element and its Uselessness as a Standard Cell. By ERNST COHEN (*Zeit. physikal. Chem.*, 1900, 34, 621—631).—Cadmium sulphate, $\text{CdSO}_4 \cdot \frac{8}{3} \text{H}_2\text{O}$, can exist in two different modifications below 15° . A cadmium amalgam with 14.3 per cent. of cadmium can exist in two different modifications below 23° . At 0° , the difference of potential between the two modifications of the cadmium amalgam amounts to 5 millivolts. It appears that the Weston cell studied in the Reichsanstalt is below 23° a meta-stable system, which may spontaneously change into a stable condition. As this change is accompanied by an appreciable alteration in the E.M.F., the Weston cells are useless as standards. The temperature formula given by Jaeger and Wachsmuth (*Abstr.*, 1897, ii, 86) applies between 0° and 23° to the meta-stable Weston cell, above 23° to the stable form of the same.

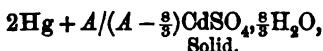
The author hints that probably similar results will be obtained in regard to the stability of the Clark cell. J. C. P.

The Weston Cell. By WILHELM JAEGER and ST. LINDECK (*Zeit. physikal. Chem.*, 1900, 35, 98—99).—Cohen (preceding abstract) has stated that below 23° the Weston cell is in a metastable state and is hence unsuitable for a normal element. The authors dissent from his views and point out that the concentration of the amalgam employed by Cohen (14.3) is considerably greater than that of the normal Weston cell (12.7). L. M. J.

Thermodynamics of Normal Cells. II. By ERNST COHEN (*Zeit. physikal. Chem.*, 1900, 34, 612—620).—The calculations made in the previous paper (this vol., ii, 520) relative to the Clark cell were based on measurements made with the system $\text{Hg} \mid \text{Hg}_2\text{SO}_4$ —saturated zinc sulphate solution \mid zinc amalgam. No error was thereby introduced, since zinc and zinc amalgam show the same potential difference in a zinc sulphate solution, provided the amalgam contains more than 2 per cent. of zinc. With the cadmium of the Weston cell, which is dealt with in the present paper, the case is different; the 14.3 per cent. cadmium amalgam used in Jaeger and Wachsmuth's work (*Abstr.*, 1897, ii, 86) shows an electromotive behaviour different from that of pure cadmium. Taking account of this, the essential changes that take place in the Weston cell are represented by the following equations: $\text{Cd} - \text{amalgam} \rightleftharpoons \text{Cd} + \text{Hg}$, and



Liquid.



Solid.

where A is the number of water molecules present for every one of cadmium sulphate in the saturated solution. On this basis, E_o , the total heat effect accompanying the passage of 2×96540 coulombs through the cell, is calculated to be 47286 cal., whilst the electrical measurements of Jaeger and Wachsmuth lead to the value 47880 cal.

J. C. P.

An Application of Poynting's Theorem. By GUSTAV MIX (*Zeit. physikal. Chem.*, 1900, 34, 522—528).—A mathematical paper not suitable for abstraction. J. C. P.

Quantitative Lecture Experiments on Electrochemistry. By W. LASH. MILLER and FRANK B. KENRICK (*J. Physical Chem.*, 1900, 4, 599—618).—The authors describe a very ingenious instrument for use on a lecture table which is capable of marking the necessary changes of resistance in a Wheatstone bridge and of indicating to a class the resistance required. The principle of the method is the following. The needle of a dead beat galvanometer of the D'Arsonval pattern, when displaced from its zero position, completes a relay circuit and by means of suitable mechanism causes a rheostat to turn and alter the resistance, the direction being dependent on the side to which the needle moves. This rheostat is provided with a dial and pointer, which indicate the resistance. When the equilibrium is reached and the

needle returns to zero, contact is broken and the motion of the rheostat ceases. The authors describe how, by means of this instrument, various electrolytic experiments may be shown to a class, as, for example, the proof of Ostwald's law, preparation of isohydric solutions, measurements of E.M.F.s, and of polarisation, &c. L. M. J.

Relations between Polarisation and Current Density in Solid and Fused Salts. By ALBERT GÖCKEL (*Zeit. physikal. Chem.*, 1900, 34, 529—558).—A number of experiments made with lead chloride, bromide, and iodide, cadmium iodide and bismuth bromide, at temperatures both above and below their melting points, show a rapid increase of the polarisation with the current density. The chief factors to be taken into account are the absorption of the liberated gases by the electrodes, and the solution and diffusion of these gases in the electrolyte. On the supposition that the concentration of the gas absorbed in the anode is proportional to the potential difference between the electrodes (compare Jahn and Schönrock, *Abstr.*, 1895, ii, 198), a formula is deduced giving the polarisation in terms of the current density. This formula agrees closely with the experimentally determined relation of polarisation and current density, except for high values of the latter and at temperatures much above the melting point of the salt. Under these conditions, the values of the polarisation approach a maximum, and a hyperbolic curve must be substituted for the logarithmic one. J. C. P.

Difference of Potential between a Solid Salt and its Solution. By A. CAMPETTI (*Atti Real. Accad. Lincei*, 1900, [v], 9, ii, 27—31).—By measuring the E.M.F. of a cell of the type $Hg | L_1 | \text{salt} | L_2 | Hg$, where L_1 and L_2 are solutions of different concentrations of the solid salt in contact with them, it is found that a difference of potential exists between a solid salt and its non-saturated solution, the order of magnitude and sign being the same as those of the potential difference existing between a concentrated and a dilute solution of the same salt. T. H. P.

Electromotive Efficiency of the Elementary Gases. I. By EMIL BOSE (*Zeit. physikal. Chem.*, 1900, 34, 701—760).—A general review of the work done on gas cells, and a discussion of their theory. The chief problems treated by the author are: (1) In what condition are the gases present in the electrode? (2) What is the part played by the electrode itself? (3) How do the metallic electrodes transmit the electromotive efficiency of the gases? (4) How far is agreement attained between measurements made with the same gas and electrolyte, but with different electrodes?

The conclusions of the paper are as follows. The electromotive efficiency of the elementary gases is determined by their solubility in the electrodes. The gases in the electrodes, on account of the high dissociating power of the latter, are to be regarded as wholly or partly dissociated into single atoms; the ions of an electromotively active substance are already present in the electrode. The electrolytic solution pressure is the product of the osmotic pressure of these ions and a factor which is a constant for each solvent, and termed by the

author the electrolytic partition coefficient. The saturation of the electrode with a gas is an extremely slow diffusion process. Grove's gas battery is reversible, but its E.M.F. with the gases under atmospheric pressure has certainly a higher value than that usually given. In the acid hydrogen-oxygen cell, the water is formed at the oxygen electrode, in the alkali hydrogen-oxygen cell at the hydrogen electrode. The second electrolytic decomposition point of water corresponds with a non-reversible process.

J. C. P.

Electromotive Behaviour of Substances with several Stages of Oxidation. I. By ROBERT LUTHER [with D. R. WILSON] (*Zeit. physikal. Chem.*, 1900, 34, 488—494).—On thermodynamical grounds, the same amount of work must be required to raise a substance from its lowest (*L*) stage of oxidation to its highest (*H*), whether this is done directly or through an intermediate (*I*) oxidation stage; thus $A_{L-H} = A_{L-I} + A_{I-H}$, where *A* is the change in the free energy. Application of this general theorem to the oxidation of copper from the metallic to the cupric stage leads to the relation: $2\Pi_{Cu} \rightarrow Cu^{++} = \Pi_{Cu+Cl} \rightarrow CuCl + \Pi_{CuCl} \rightarrow Cu^{++} + Cl^{-}$; a similar relation is deduced when bromine is substituted for chlorine. Under the supposition that the E.M.F. between metal and electrolyte depends on the concentration of the particular metallic ion, the deductions from the theory were confirmed experimentally in both the above cases.

J. C. P.

Passivity of the Metals. By WILHELM HITTOFF (*Zeit. physikal. Chem.*, 1900, 34, 385—402).—The author's work on the electromotive behaviour of chromium (Abstr., 1898, ii, 363; 1900, ii, 127) has suggested that the passive or inactive condition of iron may not be due to a superficial layer of oxide, as generally supposed. When in the combination $Fe | NaNO_3, H_2CrO_4 | Pt$, the circuit is completed by dipping the iron in the salt solution, the E.M.F. gradually falls from 1.83 to 0.1 volt; the iron becomes quite passive, retains its metallic lustre, and is not attacked, however long the cell is short-circuited. The metal gradually returns to its active condition when it is washed, dried, and allowed to lie in the air, or when the circuit is opened. These facts show that the passive condition of iron cannot be due to a film of oxide. Similar results are obtained when the sodium nitrate in the cell is replaced by other oxy-salts or by a soluble cyanide. The concentration of the electrolyte in which the iron is immersed has but little influence on the phenomenon. The longer the cell has been short-circuited, the longer is the iron in recovering its activity.

Iron becomes passive still more readily when it is made the anode with a stronger current. If the external E.M.F. is high enough to decompose the electrolyte, bubbles of oxygen are liberated at the iron anode, the latter behaving like a noble metal; at the same time, the surrounding liquid becomes acid. Iron that has become passive loses its passivity at once when it acts as a cathode. Immersion in strong nitric acid induces passivity, but the passivity lasts only as long as the immersion; to nitric acid of sp. gr. 1.35, iron is indifferent only when in contact with an electronegative conductor, such as platinum or gold; the passivity caused in this way endures after the contact is

broken. Potassium and sodium hydroxides render iron passive under the same conditions as the salts of the oxy-acids. When the iron in the cell $\text{Fe} \mid \text{NaNO}_3, \text{H}_2\text{CrO}_4 \mid \text{Pt}$ has been tarnished by heat, the E.M.F. is the same as when freshly polished iron is used, a further fact opposed to the view that passivity is due to superficial oxidation.

When nickel takes the place of iron in the cell just described, the E.M.F. likewise decreases, so that nickel also can assume the passive condition. Cobalt also is capable of passivity, but to a less extent than nickel.

The author looks on the molecules of a passive metal as being in a certain state of tension, which passes away when the metal is left to itself. J. C. P.

Oettel's Gasometric Method. By ANDRÉ BROCHET (*Bull. Soc. Chim.*, 1900, [iii], 23, 724—726).—A concise explanation of the method devised by Oettel for the continuous study of electrolysis. The volumes of hydrogen and oxygen evolved at the cathode and anode respectively, are compared with the volumes of these gases yielded by a gas voltameter placed in circuit with the electrolytic cell. N. L.

Accessory Reactions in Electrolysis. By ANDRÉ BROCHET (*Bull. Soc. Chim.*, 1900, [iii], 23, 736—740).—In the electrolysis of concentrated solutions of sodium hypochlorite, more of this salt is decomposed, and more chlorate is produced, than is required by Faraday's law. This result is explained by the fact that the liquid in the immediate neighbourhood of the anode is always acid and that the hypochlorous acid thus liberated in concentrated solution is partially transformed into chloric acid by auto-oxidation (this vol., ii, 276). The decomposition is quite independent of the electrolytic action, although indirectly caused thereby, and may fitly be termed an "accessory" reaction. N. L.

Researches on Electrolytic Reduction. By WALTHER LÖB (*Zeit. physikal. Chem.*, 1900, 34, 641—668. Compare Abstr., 1899, i, 122).—The main portion of this paper has already been abstracted (this vol. i, 697). In addition, the author replies to Haber's criticism of his views, and holds that no objection can be made to the assumption that the work of reduction in alkaline solution is effected by the sodium ions. A large number of chemical processes support this view. J. C. P.

Electrolytic Solution Pressure. Reply to Lehfeldt. By FRIEDRICH KRÜGER (*Zeit. physikal. Chem.*, 1900, 35, 18—22).—Many of the numerical data given by Lehfeldt in his criticism of the theory of solution pressure (this vol., ii, 62) are incorrect, notably the statement that for the formation of the double layer 1.27 grams of zinc per square cm. must pass into solution; the author calculates that this value should be 3×10^{-9} .

WALTHER NERNST in a footnote to the paper, also replies to Lehfeldt's statement that the theory of concentration chains was developed on an insufficient experimental basis. L. M. J.

Degree of Dissociation and Dissociation Equilibrium in the case of Highly Dissociated Electrolytes. By HANS JAHN (*Zeit. physikal. Chem.*, 1900, 35, 1—10).—The author has previously pointed out that the cause of the apparent divergences from Ostwald's law probably lies in the variation of ionic velocities (this vol., ii, 522). By E.M.F. observations, the ratio of the ionic concentrations of two solutions can be found, and, assuming Ostwald's law, the actual concentration may also be determined. The author calculates in this manner the ionic concentration of a dilute solution of potassium chloride from E.M.F. observation with six other more concentrated solutions; the values obtained from the last five solutions only vary between 0.001638 and 0.001642. Similar results were obtained for hydrochloric acid and sodium chloride. Assuming the value so obtained for the most dilute solution, the ionic concentrations of the stronger solutions were calculated and are found to agree well with the values calculated by the dilution law. By comparing these values with those obtained by conductivity experiments, the ionic velocities are determined and are found in all cases to decrease with dilution. There is hence no reason for doubting the validity of Ostwald's dilution law, even for strong electrolytes.

L. M. J.

Magnetic Force of the Atoms. By ROBERT LANG (*Ann. Phys.*, 1900, [iv], 2, 483—494).—A paper mainly physical in character. The author suggests that free valencies are responsible for the atomic magnetism, and points out that for cobalt, nickel, iron, and manganese the atomic magnetisms and the number of free valencies run parallel. It is also noted that the two conditions for the appearance of paramagnetism, namely, (1), a minimum atomic volume, (2) free valencies, are fulfilled in the case of oxygen. The author's view of the connection between free valency and atomic magnetism would explain the rule found by Meyer (this vol., ii, 7), that the molecular magnetism of paramagnetic compounds is less than the sum of the atomic magnetisms of the components.

J. C. P.

Has Magnetism an Influence on Chemical Reactions? By ALEXANDRE DE HEMPTINNE (*Zeit. physikal. Chem.*, 1900, 34, 669—682).—Although, according to theory, magnetism must have an influence on chemical equilibrium and reaction velocity, yet this influence is too small to be of any practical consequence. The electrical conductivity of a solution, the catalytic action of acids, the inversion of cane sugar, and the velocity of combination of hydrogen and chlorine are found to be unchanged in a magnetic field.

J. C. P.

Magnetic Behaviour of Alcohols. By GG. HEINRICH (*Chem. Centr.*, 1900, ii, 156; from *Sitzungsber. Bayr. Akad. Wiss.*, 1900, 33—36).—All alcohols exhibit diamagnetism. For one and the same alcohol the product of kM , the molecular magnetism, and H , the field strength is constant. This product kMH is different for different alcohols, and is not a purely additive but a constitutive constant. It has the following values: methyl alcohol, -0.185; ethyl alcohol -0.296; *n*-propyl alcohol -0.392; isopropyl alcohol -0.409; *n*-butyl alcohol -0.520; isobutyl alcohol -0.541; trimethylcarbinol -0.482; isomethyl alcohol -0.599; dimethylethylcarbinol -0.563.

J. C. P.

Magnetic Susceptibility of Aromatic Organic Substances. By HUGO FREITAG (*Chem. Centr.*, 1900, ii, 156; from *Sitzungsber. Bayr. Akad. Wiss.*, 1900, 36).—The same general relations hold as for the alcohols investigated by Heinrich (preceding abstract). The product kMH has the following values: *o*-xylene - 0.734; *m*-xylene - 0.718; *p*-xylene - 0.685; ethylbenzene - 0.675; ψ -cumene - 0.823; mesitylene - 0.773. J. C. P.

Relation between Heat of Solution and Solubility of Electrolytes. By J. J. VAN LAAR (*Zeit. physikal. Chem.*, 1900, 35, 11—17).—The author's and van't Hoff's formulæ connecting the heat of solution and solubility of electrolytes contain certain integration difficulties leading to errors which are not negligible. The author modifies his formula so as to make these smaller, and shows that it leads to better results. L. M. J.

Continuous Change and Thermodynamics. VI. By PIERRE DUHEM. (*Zeit. physikal. Chem.*, 1900, 34, 312—377).—A continuation of the author's previous papers on this subject (*Abstr.*, 1897, ii, 439; 1898, ii, 132; this vol., ii, 524), in which it is shown that the change from yellow to red phosphorus is probably an example of the same form of slow change as that of monoclinic to rhombic sulphur (*Abstr.*, 1897, ii, 439). The hardening, tempering, scorching, and forging of metals are also considered, the changes being regarded as of the nature of hysteresis and the equations previously deduced are applied. L. M. J.

Diminution of Vapour Pressure and Elevation of Boiling Point of Dilute Solutions. By A. SMITS (*Proc. K. Akad. Wetensch. Amsterdam*, 1900, 2, 635—640. Compare this vol., ii, 389).—Making use of the apparatus formerly described (*loc. cit.*), measurements have been made of the elevation of boiling point of solutions of varying concentration of potassium chloride and nitrate, and sodium chloride, and, in the case of the last salt, of the diminution of vapour pressure also. The following table gives the concentrations of the various solutions corresponding with an increase of the boiling point of water of 1°, 2°, &c.

Increase in boiling point.	Grams of salt per 100 grams water.		
	Sodium chloride.	Potassium chloride.	Potassium nitrate.
1°	7.7	9.0	12.2
2	13.4	17.1	26.4
3	18.3	24.5	42.2
4	23.1	31.4	59.6
5	27.1	37.8	78.3

Thus, in the case of potassium nitrate, the fact, already noticed for dilute solutions, that the concentration increases more rapidly than the elevation of boiling point, also holds for concentrated solutions. This is also true for dilute solutions of sodium and potassium chlorides, but with concentrations greater than 0.5 gram-mol. per 1000 grams of water the ratio of concentration to elevation of boiling point decreases.

T. H. P.

Vapour Pressure of a Series of Benzene Compounds. By BENEDIKT WORINGER (*Zeit. physikal. Chem.*, 1900, 34, 257—289).—The vapour pressure curves were determined by the statical method for benzene, hexylene, hexane, toluene, octane, ethylbenzene, *p*-xylene, *m*-xylene, *o*-xylene, propylbenzene, isopropylbenzene, decane (diamyl), isobutylbenzene, ψ -cymene, cymene, and mesitylene; expressions of the form $p = ae^{-b/\theta} \cdot \theta^{c+d \log \theta}$ are used to represent the curves, θ being the absolute temperature and a, b, c, d being constants. The vapour pressure curve of mesitylene is noticeable, as owing to the slow temperature increase it cuts those of most of the other compounds. From the results the author enunciates eleven laws, for which the original must be consulted.
L. M. J.

Cryoscopic and Ebullioscopic Researches. By ANGELO BATELLI and A. STEFANINI (*Ann. Chim. Phys.*, 1900, [vii], 20, 64—125).—The authors consider very fully the various errors of experiment in cryoscopic observations, but add nothing to what has already been published by Wildermann (this vol., ii, 131); they also discuss the results of Loomis, Jones, Abegg, Wildermann, Ponsot, and Raoult. The apparatus employed by the authors themselves is described, and the results are given of their observations with solutions of tartar emetic and sucrose. For the latter, the value 2.02 was obtained for the molecular depression in a *N*/1000 solution, but for solutions of 2.2 *N*/1000 to 4.2 *N*/100 the values only vary between 1.83 and 1.88, so the conclusion is drawn that within the limits of experimental error the molecular depression is constant, and equal to the calculated value 1.87. An apparatus for the determination of boiling points is also described, by means of which the molecular weight of tartar emetic was found, the values varying from 287 to 329.
L. M. J.

Calculations in connection with the Equations of Condition for Liquids. I. Determination of the Constants a and b of van der Waals' Equation. By PHILLIPE A. GUYE and L. FRIDERICH (*Chem. Centr.*, 1900, ii, 156; from *Arch. Sci. phys. nat. Genève*, [iv], 9, 505—536).—The authors consider that too little use has been made of the experimental data available for this purpose, and calculate the value of the constants for a number of substances, as summed up in the following table:

Substance.	T_c .	P_c .	a .	b .	Substance.	T_c .	P_c .	a .	b .
			0.0	0.00				0.0	0.00
NH ₃	408	114	82	162	HCO ₂ Me ...	487	59.3	236	384
NH ₂ Me.....	428	72	148	276	HCO ₂ Et ...	508	46.8	330	511
NHMe ₂	436	56	198	362	CH ₃ CO ₂ Me	507	46.3	515	514
NH ₂ Et.....	450	66	178	316	CH ₃ CO ₂ Et	523	38.0	438	654
NMe ₃	433.5	41	271	495	C ₆ H ₅ Cl.....	634	45	427	596
NH ₂ Pr.....	491	50	236	460	C ₆ H ₅	562	49	390	569
NH ₂ Et ₂	489	40	359	576	C ₆ H ₅ Me ...	594	42	524	684
NHPr ₂	550	31	611	855	H ₂ O.....	637	195	1204	147
NEt ₃	532	30	589	852	HCl.....	325	86	704	174
OMe ₃	403	57	165	328	SO ₂	428	79	1345	251

In the course of these calculations the authors find empirically a numerical relation between b , the critical pressure P_c , and the critical temperature T_c .
J. O. P.

A New Coal Calorimeter. By SAMUEL W. PARR (*J. Amer. Chem. Soc.*, 1900, 22, 646—652).—The apparatus differs from those usually employed in the fact that no gaseous oxygen is required, the coal being burned by means of sodium dioxide; the carbon dioxide and water produced are absorbed by the sodium oxide formed.

One gram of the sample, dried at 105° , is mixed with 17 grams of sodium dioxide, the mixture is put into a cartridge which is placed into an insulated vessel containing a certain volume of water of known temperature. The charge is fired by means of a red hot copper wire, the increase in temperature is noticed, and the usual calculation made. For exact particulars of the construction of the apparatus and the cartridge, the illustrations of the original paper should be consulted.

An allowance of 27 per cent. of the total indicated heat must be made on account of the heat developed in the combination of the carbon dioxide and the water with the chemical employed. An allowance must also be made for the use of the hot copper wire; the average of many determinations on various lengths up to 2 inches established a fairly uniform factor of 0.012° per half-inch of No. 12 copper wire.

L. DE K.

Heat of Formation of Alloys. By J. B. TAYLER (*Phil. Mag.*, 1900, [v], 50, 37—43).—The heats of formation of a number of alloys were determined by measuring the heat of solution in mercury of the alloy and of the mixed metals, the assumption being made that the solutions are identical. It was thought that combination only took place for a very small proportion of the mixed metals, and that the best results would therefore be obtained when one metal is present in great excess, but the results showed that in this case far greater values for the heat of formation are obtained.

L. M. J.

Want of Uniformity in the Action of Copper-Zinc Alloys on Nitric Acid. By JOHN H. GLADSTONE (*Phil. Mag.*, 1900, [v], 50, 231—237).—The heats of formation of copper-zinc alloys have been determined from observations on the heat of dissolution of alloys and mixtures in nitric acid. These are shown to be untrustworthy, inasmuch as the products of the reaction are not similar in the two cases. By comparison of the heats of dissolutions of a few alloys rich in copper, for which, however, the products are practically identical, the author finds that the heat evolved is less than would be expected, and considers the deficit must be regarded as due to the heat of formation of the alloy. Further experiments are, however, desirable, with solvents the action of which is simpler than that of nitric acid (compare preceding abstract).

L. M. J.

Steam and Brines. By JOHN Y. BUCHANAN (*Trans. Roy. Soc. Edin.*, 1898, 39, 529—573).—The temperatures of boiling mixtures of steam and numerous salts have been determined under different pressures, the method followed being to blow steam through the coarsely powdered salt. The boiling temperature of the mixture is constant so long as there is an abundant supply of steam and salt,

The experiments were continued after all the salt was dissolved, the weight of steam condensed and the temperature of the liquid being observed at intervals; in this way, the concentrations and boiling temperatures of salt solutions of different strengths were determined.

The most complete series of experiments were those made with sodium chloride. In these, the atmospheric pressure varied from 550—772 mm., and the temperature of saturated steam from 91·2—100·44°, the corresponding temperatures of the boiling saturated solution being 99·3° and 108·98°. The ratio of the atmospheric pressure to the vapour tension of water at the temperature of the boiling mixture is practically constant, and equal to 0·7435. The other salts experimented with were potassium, ammonium and barium chlorides, potassium chlorate, sodium, barium, strontium and lead nitrates, potassium and ammonium sulphates. For these salts, the ratio $(p - P)/p$, where P is the atmospheric pressure, and p is the vapour tension of water at the temperature of the boiling mixture, decreases with falling pressure; this depends chiefly, if not entirely, on the diminished solubility of the salt at the lower temperature.

When $t - T$ is the difference between the boiling point of a solution and the boiling point of water at the same time and place, and W is the weight of steam condensed between the beginning of the experiment and the time when the difference of boiling points is $t - T$, it is found that $W(t - T)$ for some salts is nearly constant. For sodium and potassium chlorides, the values of $W(t - T)$ diminish very considerably as W increases.

One or two solubilities at the boiling point t of the saturated solution may be noted; the quantity of salt taken in each case is 0·2 gram-molecule.

	NaCl.	KCl.	BaCl ₂ .	(NH ₄) ₂ SO ₄ .
t	108·98°	108·94°	104·46°	107·03°
a	29·9	25·9	64·0	25·0

a is the weight of steam condensed for complete solution.

J. C. P.

The Law of Cailletet and Mathias and the Critical Density. By SYDNEY YOUNG (*Phil. Mag.*, 1900, [v], 50, 291—305).—By the examination of the known data in the case of about 30 different compounds, the author tests the validity of the law of Cailletet and Mathias which states that the mean of the densities of liquid and saturated vapour of any stable substance is a rectilinear function of the temperature. The law is not found to be absolutely true, but is a very close approximation, the values, when plotted, forming a curve the curvature of which decreases the more nearly the ratio of the actual to the theoretical critical density approaches the theoretical value 3·77. This is well seen in the case of *n*-pentane, for which the ratio is 3·765 and for which the law holds accurately. The curvature is also found to be in opposite directions according as the ratio is greater or less than 3·77. The ratio $\alpha T_c/D_c$, where α is the temperature coefficient of the mean density, appears to have a normal value of 0·93 and varies in the same sense as the above ratio. The curvature of the mean density curve is as a rule so slight that the critical density may be

calculated if the extrapolation is small, but errors of 5 or 6 per cent. may occur if the calculation is made from the mean densities at temperatures below the boiling point.

L. M. J.

Velocity of Solidification and Viscosity of Supercooled Liquids. By HAROLD A. WILSON (*Phil. Mag.*, 1900, [v], 50, 238—250).—The velocity of solidification of a supercooled liquid increases with the supercooling until a maximum constant value is reached, after which it may decrease; various explanations, but none entirely satisfactory, have been given for this (Tammann, *Abstr.*, 1898, ii, 425). The author, starting with the supposition that solidification is due to the difference of internal pressure between liquid and solid at the surface of separation and the consequent forcing of liquid molecules into the solid, deduces the expression $v = Cs/V$, where v is the velocity of solidification, c a constant, s the supercooling, and V the viscosity of the liquid. The temperature at the surface of separation of solid and liquid is not equal to that of the main bulk, and was determined in the case of salol by means of a small thermo-couple, and the values of the supercooling were corrected. The viscosity was also determined, and the value of C being deduced from the experiments the values of v were calculated for the whole series and found to agree well with the observed values. Concordant values were also obtained for benzoic anhydride, benzophenone and azobenzene, although the corrections for the overcooling were not found, and the author's formula appears to be well justified.

L. M. J.

Extent to which the Interaction of Ionic Charges diminishes the Osmotic Pressure. By VL. VON TÜBIN (*Zeit. physikal. Chem.*, 1900, 34, 403—408).—A mathematical paper not suitable for abstraction.

J. C. P.

A Model to Show Ionic Mobility. By FRIEDRICH KOHLRAUSCH (*Zeit. physikal. Chem.*, 1900, 34, 559—560).—Small metallic cylinders representing various ions have attached to them cords passing over grooved wheels, and move up and down in channels cut in the face of an upright wooden board. The size of the wheels is so adjusted that the velocities of the cylinders upwards and downwards are in the ratio of their ionic velocities.

J. C. P.

Supposed Isomerism of Red and Yellow Mercuric Oxide, and the Surface Tension of Solid Bodies. By WILHELM OSTWALD (*Zeit. physikal. Chem.*, 1900, 34, 495—503).—The difference of potential found by Cohen (this vol., ii, 184, 381) is not necessarily in conflict with the author's view that the only distinction between red and yellow mercuric oxide lies in the size of the grains. Such a difference in grain would mean a difference in solubility, and this again would cause a difference in potential. The author describes how the red oxide by mere rubbing up in a mortar takes on the colour of the yellow oxide. That the fine precipitated yellow oxide is more soluble than the larger grained red oxide was shown by shaking each with normal potassium bromide solution until equilibrium was established (compare Bersch, *Abstr.*, 1891, 1413). As the red oxide was powdered its solubility gradually approached that of the yellow oxide.

The author regards this case as illustrating the influence of surface tension on chemical equilibrium, and describes further experiments in which a difference in grain size was found to cause a difference in solubility. When two corresponding values of the grain size and solubility are known, a formula may be obtained for the surface tension between solids and their saturated solutions. J. C. P.

Composition of the Surface Layers of Aqueous Solutions. By JAN VON ZAWIDZKI (*Zeit. physikal. Chem.*, 1900, 35, 77—80).—A small quantity of saponin was mixed with solutions of acids, and a current of air, previously passed through a similar solution (without the saponin), was drawn through the acid causing it to froth up, this froth being collected and condensed in a second vessel. The concentrations of acid in the solution and froth were then determined. With acetic and hydrochloric acids, an increase of 0.4 and 0.8 per cent. respectively was found; this could not be an effect of volatility, as, apart from the precautions observed, the variation due to this cause should be in opposite senses for the two acids. The results hence confirm theoretical deductions that the concentration is greater in the surface layers. L. M. J.

Formation of Salts in Alcoholic Solutions. By SIMEON TANATAR and BORIS KLIMENKO (*Zeit. physikal. Chem.*, 1900, 35, 94—95).—The authors' previous experiments were extended to propionic, caprylic, hippuric, acetic, and chloroacetic acids (see Abstr., 1898, ii, 563). The heat of neutralisation by ammonia was in all cases greater than that by potassium hydroxide, and the values are not in the same order. For potassium hydroxide, the values lie between 7.4 and 8.9, and for ammonia between 11.5 and 14.4, so that they differ considerably from the values in aqueous solutions. The authors intend to further determine the dependence of the values on the state of ionisation. L. M. J.

Colloidal Metallic Solutions. By K. STOECKL and LUDWIG VANINO (*Zeit. physikal. Chem.*, 1900, 34, 378—379).—A controversial paper in which the authors defend their views concerning the nature of colloidal solutions (this vol., ii, 11). L. M. J.

Flocculation of Turbid Media. By WALTHÈRE SPRING (*Rec. Trav. Chim.*, 1900, 19, 204—235).—This paper commences with an historical summary of the researches of previous observers on liquids rendered turbid by the presence of solid substances in a minute state of division (pseudo-solutions), and a bibliography of the subject is given in an appendix. Details are then given of the author's own experiments, the results of which are summarised as follows.

Solutions of salts which, like those of polyvalent metals, cannot be obtained in an optically transparent condition (Abstr., 1899, ii, 537) bring about the flocculation of turbid liquids much more readily than solutions of any other salts. This result is due partly to the agglutinative power of the metallic hydroxides formed by the hydrolysing action of the water, and partly to the flocculating action

of the acids simultaneously produced. The extent of the flocculation caused by hydroxides is closely connected with their chemical and physical character as well as with the nature of the turbidity. The behaviour of the turbidity towards salt solutions somewhat resembles that of a membrane, the acid formed by the hydrolysis of the salt traversing the liquid by diffusion whilst the metallic hydroxide is precipitated with the substance causing the turbidity. The persistence of very fine turbidities bears a relation to the Brownian motion. In consequence of this motion, particles suspended in pure water frequently collide with one another without coming into actual contact, but if an electrolyte is present the particles agglutinate, the Brownian motion ceases, and the flocks formed are deposited. The flocculation of liquids is not brought about by electrical action at a distance, as by Röntgen rays or the electricity developed by a statical machine or an induction coil, and cannot therefore be compared with the precipitation of dust particles in air. The feeblest electric current is, however, sufficient to induce clarification, which in the majority of cases commences at the cathode. Electrolytes of the same conductivity but having different anions and cations influence the flocculation very unequally. Electrolytes having the same cation induce flocculation in equal times, whilst the nature of the anion plays only a secondary part. The rate of flocculation in different electrolytes having the same anion is exactly in the order of the velocities of the cations in electrolysis. It therefore appears that the primary cause of the flocculation brought about by electrolytes is to be sought in the velocities of the ions. N. L.

Solid Solutions and Isomorphous Mixtures of Saturated and Non-saturated Open-chain Compounds. III. By GIUSEPPE BRUNI and F. GORNI (*Atti. Real Accad. Lincei*, 1900, [v], 9, ii, 151—156. Compare Abstr., 1899, ii, 731).—The isomorphism existing between stilbene and dibenzyl (*loc. cit.*) is also observed in their *pp*-dimethyl-derivatives. Stilbene, diphenylmethane, and diphenylamine do not form isomorphous mixtures as is the case with phenanthrene, fluorene, and carbazole, although the three compounds of each group are similarly related to one another. Neither cinnamic nor *allocinnamic* acid forms solid solutions with phenylacetic acid, but this property is exhibited by *p*-nitrobenzoic acid and *p*-nitrobenzaldehyde. T. H. P.

Limits of the Solid State. V. By GUSTAV TAMMANN (*Ann. Phys.*, 1900, [iv], 3, 161—194. Compare Abstr., 1899, ii, 635).—For pressures between 1 and 1200 kilograms per sq. cm. (the corresponding melting points being 5.4° and 36.5°), the latent heat of fusion of benzene has the mean value 30.7 cal., and does not vary appreciably. The volume changes accompanying fusion have been determined at different points on the melting point curve for benzene, naphthalene, phosphorus, and dimethylethylcarbinol; the volume change is found to diminish proportionally to the rising temperature of fusion, although considerable deviations from this rule are noted in the case of benzene above 60° . The volume change accompanying the transition of rhombic into monosymmetric sulphur is practically the same for all points on the transition point curve. The lowering of the freezing

point due to foreign substances increases markedly with rising pressure.

The author then discusses the general form of the melting point curve in the light of these results. His previous contention that the volume change and latent heat of fusion do not simultaneously become zero is upheld. Further, in the case of a transition, when the volumes of the two phases are equal, one at least being crystalline, the transition is accompanied by a change of energy. J. C. P.

Equilibrium between Lead and Zinc, and Mixtures of their Fused Chlorides. By W. REINDERS (*Zeit. anorg. Chem.*, 1900, 25, 126—145).—When a mixture of fused zinc and lead chlorides is electrolysed between carbon poles with a potential difference of 15—30 volts, the metallic regulus formed consists almost entirely of lead, even when the percentage of lead chloride in the fused mixture is small. At the temperature of the experiments (515°) zinc and lead are only partially miscible, and it might be expected that the curve connecting the percentage of lead in the regulus with the percentage of lead chloride in the fused mass would show a discontinuity. The curve, however, is found to be continuous, and it is suggested that in the electrolysis the proportions of the two metals liberated are not those which are in equilibrium with the fused mixture. A simple assumption would be that they are separated in the same ratio in which they are present in the fused mixture, and that the establishment of equilibrium is a subsequent and secondary process. Experiments were made in which zinc, zinc chloride, and lead chloride were shaken up together for several hours at 515°. The greater portion of the lead is found in the regulus at the end of the experiment, and it appears that in all cases where the percentage of lead chloride in the fused mixture is greater than 0.1, the regulus consists almost exclusively of lead.

If lead and zinc were miscible in all proportions the potential difference regulus | fused mixture would change continuously from the value for $\text{Pb} | \text{PbCl}_2$ to that for $\text{Zn} | \text{ZnCl}_2$. Since, however, the metals are only partially miscible, this will not be the case. When a mixture of the fused salts is in equilibrium, (1) with the saturated solution of zinc in lead, (2) with the saturated solution of lead in zinc, the potential differences in the two cases should be equal. This is borne out by experiment, for it is found that the E.M.F. of the combination $89.36\text{Pb} \ 10.64\text{Zn} | 99.9\text{ZnCl}_2 \ 0.1\text{PbCl}_2 | \text{PbCl}_2 | \text{Pb}$ is the same as that of the combination $3.16\text{Pb} \ 96.83\text{Zn} | 99.9\text{ZnCl}_2 \ 0.1\text{PbCl}_2 | \text{PbCl}_2 | \text{Pb}$, namely, 0.278 volt at 515°. The potential difference $\text{Pb} | \text{PbCl}_2$ is raised by the addition of zinc. J. C. P.

Solubility of Carbonates of Alkaline Earths in Water containing Carbon Dioxide. By GUIDO BODLÄNDER (*Zeit. physikal. Chem.*, 1900, 35, 23—32).—The formulæ representing the equilibrium between carbonates, bicarbonates, and carbon dioxide are deduced, these leading to the result $\text{K} \cdot \text{CO}_2 = k(\text{HCO}_3)_2^2$, or $\text{HCO}_3/k \sqrt{\text{CO}_2} = \sqrt{k}$. The values for \sqrt{k} are hence determined for solutions of calcium and barium carbonates, with results satisfactorily constant. The case of

magnesium carbonate is more complicated on account of the solubility of the hydrated magnesium carbonate, but this being taken into consideration, concordant results are obtained. The hydrolysis is also calculated for each of the compounds, and it is shown that the bicarbonates can only exist in solution in the presence of free carbon dioxide.

L. M. J.

Theory of the Fractional Precipitation of Neutral Salts and its Application in Analytical Chemistry. By ALEXANDER FINDLAY (*Zeit. physikal. Chem.*, 1900, 34, 409—436).—The author has studied the reversible reaction $\text{PbSO}_4 + 2\text{NaI} \rightleftharpoons \text{PbI}_2 + \text{Na}_2\text{SO}_4$, and found that the equilibrium constant given by the equation $K = C_2^2/C_1$, where C_1 and C_2 are the concentrations of the iodine and sulphate ions respectively, has a value between 0.25 and 0.30 at 25°. This result was obtained analytically, lead sulphate and iodide being shaken up with a mixed solution of sodium sulphate and iodide until equilibrium was established. The degrees of dissociation of the salts in the mixed solution were calculated by Kay's method (this vol., ii, 198).

The equilibrium constant of such a reaction as this defines the extent to which a separation of two salts by fractional precipitation can be effected. The addition of a soluble lead salt to a mixed solution of sodium iodide and sulphate causes the precipitation of lead iodide when the ratio C_2^2/C_1 in the solution is greater than K ; when, by the removal of iodine ions, the ratio C_2^2/C_1 has become equal to K , further addition of soluble lead salt precipitates both sulphate and iodide. When the ratio C_2^2/C_1 in the solution is less than K , lead sulphate is precipitated first. A few experiments showed that the rate of precipitation of lead iodide is greater than that of lead sulphate.

The values of K obtained analytically were confirmed electrically. The E.M.F.s of the electrodes $\text{Pb} \mid \text{PbI}_2, \text{NaI}$ and $\text{Pb} \mid \text{PbSO}_4, \text{Na}_2\text{SO}_4$ were determined separately with the help of a normal electrode, and combination of the values for the separate electrodes gave the E.M.F. Π of the cell $\text{Pb} \mid \text{PbI}_2, \text{NaI} \mid \text{Na}_2\text{SO}_4, \text{PbSO}_4 \mid \text{Pb}$. From theoretical considerations $\Pi = 0.02953 \log.(K/a)$, where K is the equilibrium constant and a the ratio C_2^2/C_1 in the solutions employed. The values of K calculated from this equation agree with those obtained analytically.

J. C. P.

Studies on Inversion. I. By ERNST COHEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1900, 2, 618—634).—Rayman and Šulc (Abstr., 1897, ii, 136) have shown that solutions of cane sugar in very pure water undergo inversion with a steadily increasing velocity, and Kullgren finds, further, that non-electrolytes, such as glycerose and sucrose, exert a retarding influence on the hydrolysis of ethyl acetate by sodium hydroxide, due probably to the formation of a sodium derivative of the sugar. The author has extended these investigations on the apparent acidic nature of the sugars, by studying the effect of sucrose, invert sugar, dextrose, lævulose, and mannitol on the velocity of hydrolysis of $N/40$ ethyl acetate by $N/40$ sodium hydroxide at 25°.

The following table gives the velocity constants for various concentrations of the different sugars, the value for pure water being 6.86 :

	Concentration of Sugar.				
	N/5.	N/10.	N/20.	N/40.	N/80.
Sucrose	2.01	3.12	4.29	5.19	5.88
Invert sugar	0.38	0.67	1.17	2.03	3.38
Dextrose	0.79	1.37	2.32	3.69	4.79
d-Lævulose	0.59	1.02	1.88	3.04	4.27
Mannitol.....	5.17	5.85	6.18	6.40	6.81

Thus, whilst mannitol resembles methyl and ethyl alcohols (Kullgren) in exerting but a slight influence on the velocity of hydrolysis, the sugars, on the other hand, have a considerable retarding effect.

T. H. P.

Action of Bromine on Phenylsulphonacetic Acid and α -Phenylsulphonpropionic Acid in Aqueous Solution : a Contribution to Chemical Kinetics. By LUDWIG RAMBERG (*Zeit. physikal. Chem.*, 1900, 34, 561—592).—Bromine reacts with phenylsulphonacetic acid in several stages ; the first two of these, consisting in the formation of mono- and di-bromophenylsulphonacetic acids, takes place with velocities which are approximately in the ratio 1.6 : 1. When the concentration of the bromine is high and the halogen is in excess, the reaction velocity is nearly proportional to the product of the concentration of the reacting acid and the square root of the bromine concentration. When the bromine concentration is low, the reaction velocity is proportional to the product of the concentrations of the reacting substances ; the lower the concentration, the more accurately does this rule apply. In explanation of the somewhat complicated phenomena, the author supposes that the bromine molecules in the solution are split into atoms to an extent depending on the concentration, and that only these atoms take part in the reaction.

The reaction between bromine and α -phenylsulphonpropionic acid, which is a case of simple substitution, has also been studied. The reaction velocity is found to depend in the same manner as above on the concentrations of the reacting substances. The relative velocity of the reactions becomes greater with increasing dilution.

The paper contains also a short account of the action of iodine on phenylsulphonacetic acid, and the formation therefrom of phenyl-diiodomethylsulphone. The reaction does not lend itself to investigation on the lines indicated above.

J. C. P.

Physical Condition of Substances Insoluble in Water formed in Gelatin. By CORNELIS A. LOBBY DE BRUYN (*Rec. Trav. Chim.*, 1900, 19, 236—249).—Details of work already published (this vol., ii, 136).

N. L.

G. Linck's Crystallographic Views. By GOTTLÖB LINCK (*Ber.*, 1900, 33, 2284—2287).—The author replies to the criticisms of Muthmann (this vol., ii, 533) by quoting a number of observations to prove the validity of his crystallographic method for correcting atomic weights.

E. G.

Laboratory Apparatus. By FREDERICK W. STREETFELD and FRANK SOUTHERDEN (*Chem. News*, 1900, 82, 56).—To aid in the distillation of substances which tend to solidify in the condenser, a second tube is passed through the inner tube; into this steam can be admitted when any obstruction is threatened.

A second apparatus is to serve for drying substances in a current of hot air previous to taking the melting points. The substance is placed on a piece of drying paper in the horizontal limb of a piece of bent combustion tube held in a clamp, the other limb is turned downwards at an angle of 140° and is heated by a Bunsen burner. The temperature can be adjusted by manipulating the flame, and is recorded and controlled by a thermometer suspended horizontally with the bulb just above the substance. D. A. L.

Modification of the Water Vacuum Pump. By MARTIN H. ITTNER (*Amer. Chem. J.*, 1900, 24, 253—255).—The author has devised an improved form of the water-pump, which has been found to be well adapted for distillation under low pressures. The most important point is that the water supply is drawn from a large bottle, the water level in which is kept constant, so that no water will be drawn back into the vessel which is being exhausted and the pressure is not liable to variation by bubbles of air being carried over into the pump with the water. For details, the diagram in the original must be consulted. E. G.

Economical Constant Gas Generator. By GEORG AUGUST KOENIG (*Zeit. anal. Chem.*, 1900, 39, 508—511).—This generator is designed both to check the waste of hydrogen sulphide which occurs in many laboratories and to furnish the gas instantly even when the laboratory temperature is too low for dilute sulphuric acid to react with ferrous sulphide. The ferrous sulphide is contained in a tubular vessel with a water jacket which is kept at 80° by a small flame. The acid drops in at the top of the generator from a stopcock thistle funnel. This funnel can be replenished from a reservoir, but if made to hold 50 c.c. and supplied with $N/2$ acid, a single filling suffices for almost any qualitative reaction. The neutralised acid flows away by a wide-bore stopcock and rubber tube at the lower end of the generator; only about 5—8 per cent. of the acid escapes neutralisation. M. J. S.

Inorganic Chemistry.

Influence of Finely Divided Platinum on the Combination of Hydrogen and Oxygen. By WILLIAM FRENCH (*Chem. News*, 1900, 81, 292—294. Compare *Proc.*, 1897, 13, 52).—Experiments are described in which oxygen and hydrogen in electrolytic mixture and thoroughly dried did not combine when exposed to dry platinum sponge, although the same mixture exploded when ignited or when

brought into contact with moist platinum sponge especially in presence of light. D. A. L.

Action of Permanganate on Hydrogen Peroxide and on Caro's Acid. By ADOLF VON BAEYER and VICTOR VILLIGER (*Ber.*, 1900, 33 2488—2497).—Berthelot, who noticed that, when a dilute sulphuric acid solution of potassium permanganate is added to hydrogen peroxide at -12° , the colour of the mixture disappears without the evolution of oxygen, attributed this result to the formation of the peroxide H_2O_3 (*Abstr.*, 1880, 444). This explanation, however, is incorrect, the phenomenon being one of supersaturation; the gas is readily evolved on shaking the solution and the rate of evolution depends on the temperature; the time required for the liberation of the theoretical amount at -16° is 20 minutes, whilst at $+15^{\circ}$ this velocity is doubled.

A given quantity of potassium permanganate evolves more oxygen when mixed with Caro's acid than with hydrogen peroxide. Bach supposed that this was due to the existence of a higher peroxide H_2O_4 (this vol., ii, 470). This view of the reaction is erroneous, the result being due to a catalytic decomposition of Caro's acid. The amounts of oxygen evolved vary with the temperature and at 0° , 18° , and 34° they are equal, respectively, to 2.5, 3.5, and 4.5 times the volume of the gas evolved from hydrogen peroxide. The Caro's acid employed by Bach consisted of a mixture of this reagent with hydrogen peroxide; the latter substance first reduces a portion of the permanganate to manganous sulphate, a portion of the Caro's acid then oxidises this salt to manganic sulphate, the peroxidised salt subsequently acting catalytically on the remainder of the oxidising agent decomposing it with the evolution of oxygen. This catalytic decomposition of Caro's reagent depends on the presence of manganous sulphate, an acid solution of potassium permanganate having no immediate action on pure Caro's acid; excess of the proto-salt, however, exercises a retarding influence, and when it is added to the reacting mixture at the commencement of the experiment, the time required to complete the decomposition is 3 hours instead of 20 minutes.

The paper contains a discussion of the explanations put forward by Schönbein, by Weltzien and Traube, and by Berthelot to account for the reaction between hydrogen peroxide and permanganic acid.

Pure Caro's acid is prepared by triturating potassium persulphate with concentrated sulphuric acid and pouring the mixture on to chopped ice; the solution thus produced is shown to be free from hydrogen peroxide by testing with titanousulphuric acid. A dilute sulphuric acid solution of Caro's acid and potassium permanganate may be employed in testing the relative stability of organic compounds towards oxidising agents. The liquid paraffins ("Benzin") decolorise the solution very slowly, hexamethylene more rapidly, and benzene immediately.

Oxalic and succinic acids are exceedingly stable towards this reagent whilst phthalic and adipic acids are rapidly attacked. G. T. M.

Autoxidation. By FRITZ HABER (*Zeit. physikal. Chem.*, 1900, 34, 513—521).—A discussion of the theory of oxidation both in absence and in presence of water. The equation $O_2 + 2H_2O \rightleftharpoons 2H_2O_2$ is resolved into the two others: (1) $O_2 \rightleftharpoons O + O$, (2) $O_2 + H_2O \rightleftharpoons H_2O_2 + O$. These two equations indicate the connecting link between the phenomena of oxidation in presence of water and those in absence of water. The slowness of many reactions in absence of water is then to be accounted for by the different reaction velocities of the equations (1) and (2). The author treats the subject also from the purely dynamical point of view.

J. C. P.

Autoxidation. II. By FRITZ HABER and FR. BRAN (*Zeit. physikal. Chem.*, 1900, 35, 81—93).—Ostwald has attributed autoxidation to the formation of intermediate peroxides, and has shown that the two processes must be capable of expression by definitely connected equations. The author shows that this is the case if autoxidation in the presence of water is attributed to the formation of hydrogen peroxide, and in all the cases examined (namely, the following pairs, sodium sulphite and sodium arsenite, sodium sulphite and nickelous hydroxide, indigo and benzaldehyde, triethylphosphine and indigo, potassium ferrocyanide and benzaldehyde), one of the compounds is reactive with hydrogen peroxide, whilst the other is not. The equations representing the oxidation may be written $M + O_2 + H_2O = MO + H_2O_2$; $M + H_2O_2 = M(OH)_2$ (compare this vol., ii, 593, and preceding abstract).

L. M. J.

Change in Composition of Liquid Air on Evaporation. By A. A. GROUSINOFF (*J. Russ. Phys. Chem. Soc.*, 1900, 32, ii, 107—114).—Liquid air, obtained from Linde's apparatus, was allowed to evaporate from a Dewar vacuum tube, the gas formed being collected and analysed. The results show that the law expressing the change in composition of liquid air on evaporation is independent of the speed of evaporation. From the numbers obtained, curves are constructed showing the variation of the percentage of oxygen with the proportion of the air evaporated, and also the percentage of oxygen at any time during the evaporation. These curves show that the liquid air prepared by Linde's apparatus contains 32.5 per cent. of oxygen which is reduced to the normal proportion (21 per cent.) after 40 per cent. of the liquid has evaporated.

T. H. P.

Nature of the Accessory Combustible Gases in the Air of Paris. By ARMAND GAUTIER (*Compt. rend.*, 1900, 131, 535—539).—The ratio of carbon to hydrogen in the products of combustion of the air of Paris, after the hydrogen present in the free state (this vol., ii, 537, 538) has been taken into account, is always higher than that corresponding with methane. The reaction with iodic anhydride shows that this highly carburetted gas is not an olefine or an acetylene, and it is therefore in all probability benzene and its analogues, or some of the pyrogenic hydrocarbons. Assuming it to be benzene, the combustible constituents in 100 litres of Paris air are,

on an average, hydrogen, 19.5 c.c.; methane, 12.1 c.c.; benzene and its analogues, 1.7 c.c.; carbon monoxide with traces of olefines and acetylenes, 0.2 c.c.

C. H. B.

Formation of Ozone by a Point-discharge in Oxygen. By EMIL WARBURG (*Sitzungsber. k. Preuss. Akad. Wiss.*, 1900, 712—721).—A formula is deduced for the rate of formation and decomposition of ozone by means of a point-discharge in oxygen, and has been verified by experiments carried out in a 'differential ozonometer' in which the amount of ozone produced is determined from the decrease or increase of pressure. The maximum percentage of ozone by volume was found to be 5.74 at -71° , 4.19 at 0° , 3.53 at 17° , 2.22 at 50° , and 1.23 at 93° , and the rates at which the ozone is produced and decomposed at each of these temperatures were determined separately by measuring the velocity of change. In a second series of experiments, a negative point-discharge was found to give about three times as much ozone as a positive discharge at 0° , 19° , and 48° . T. M. L.

Ozone. IV. By ALBERT LADENBURG (*Ber.*, 1900, 33, 2282—2284).—A reply to Brunck (this vol., ii, 572), who has recently cast doubt on the validity of the author's determinations of the molecular weight of ozone.

E. G.

Molecular Weight and Vapour Density of Sulphur. By OTTO BLEIER and LEOPOLD KOHN (*Monatsh.*, 1900, 21, 575—620).—As the numbers previously obtained (this vol., ii, 203) do not exclude the possibility that the sulphur molecule is greater than S_8 , and that at the temperatures employed, partial dissociation had occurred, further series of determinations have been made. They show that at the same temperature but with slight increments in pressure the density of sulphur vapour gradually approaches the value eight, but so gradually that it never actually reaches it. As this has been proved for several temperatures it is concluded that the molecule of sulphur must contain eight atoms. The authors claim that their method for vapour density determinations of dissociated vapours under reduced pressure is free from the serious objections which have been raised against the V. Meyer method.

The sulphur obtained in the apparatus at the end of the experiments is the modification insoluble in carbon disulphide, but at the higher temperatures, namely, in diphenylamine vapour and occasionally in amyl benzoate vapour under reduced pressure and in an atmosphere of nitrogen, a black modification of sulphur with a high metallic lustre has been observed. This variety is only slowly volatile, burns with a bright luminous flame, and is less brittle than yellow sulphur. It is possible that it is identical with the substance known as Magnus's black sulphur or with the modification of sulphur described by Dietzenbacher (*Compt. rend.*, 1863, 56, 39), and there is a further possibility that it may contain organic matter.

After determinations in amyl benzoate vapour, part of the sulphur is often left as clear, oily drops, which solidify when touched.

J. J. S.

Action of Alkaline Hydroxides, of Water and of Hydrogen Peroxide on Nitrogen Iodide. By F. D. CHATTAWAY and K. J. P. ORTON (*Amer. Chem. J.*, 1900, 24, 318—330. Compare Proc., 1899, 15, 18).

Action of Acids on Nitrogen Iodide. By F. D. CHATTAWAY and H. P. STEVENS (*Amer. Chem. J.*, 1900, 24, 331—341. Compare Proc., 1899, 15, 19).

Formation and Constitution of Nitrogen Iodide. By F. D. CHATTAWAY and K. J. P. ORTON (*Amer. Chem. J.*, 1900, 24, 342—355. Compare Proc., 1899, 15, 20).

Condition of Nitrous Acid in Aqueous Solutions. By A. V. SAPOSCHNIKOFF (*J. Russ. Phys. Chem. Soc.*, 1900, 32, 375—381).—At 0°, aqueous solutions of nitrous acid are stable but on heating, gradual decomposition takes place according to the equation: $3\text{HNO}_2 = \text{HNO}_3 + 2\text{NO} + \text{H}_2\text{O}$. The author has investigated the rate of this decomposition and also the conditions of equilibrium of aqueous nitrous acid in an atmosphere of nitric oxide, but no equilibrium constant could be determined. On mixing chloroform with an aqueous solution of nitrogen trioxide, the latter becomes distributed between the two solvents but the concentration ratio has not a constant value. T. H. P.

Reaction of Nitroso-derivatives. By ANGELO ANGELI and FRANCESCO ANGELICO (*Atti Real. Accad. Lincei*, 1900, [v], 9, ii, 44—46. Compare this vol., ii, 594).—The ready resolution of nitrohydroxylaminic acid into nitrous and hyponitrous acids which is brought about by the action of aldehydes or of metallic sulphites, is further exemplified by the action of nitroso-derivatives in which the nitrogen atom is tervalent in function. Thus nitrosobenzene is readily dissolved by an aqueous solution of sodium nitrohydroxylamine, yielding the sodium salts of nitrous acid and of nitrosophenylhydroxylamine. T. H. P.

Reduction of Nitrates by Lactic Acid. By LUDWIG VANINO and O. HAUSER (*Zeit. anal. Chem.*, 1900, 39, 506—507).—The dry nitrates of bismuth, mercury (both mercurous and mercuric), cadmium, silver, lead, cobalt, and nickel, are decomposed, with separation of the respective metals, when heated with lactic acid. The chlorides and sulphates of the same metals show no reduction, neither do the nitrates of aluminium, the alkaline earths, and alkalis. Ferric nitrate gives a black magnetic powder, but whether this is metallic iron has not been ascertained. M. J. S.

Preparation of Phosphorus Free from Arsenic. By EMILIO NOELTING and W. FEUERSTEIN (*Ber.*, 1900, 33, 2684—2685).—By distilling ordinary phosphorus twice with steam in a current of carbon dioxide, a product is obtained, which, on conversion into the red modification, and treatment with ammonium nitrate, yields no trace of arsenic; Winkler's view (this vol., ii, 476) as to Fittica's supposed transformation of phosphorus into arsenic is thus confirmed.

W. A. D.

Composition of Soot from Mineral Coal. By H. WARTH (*Chem. News*, 1900, 82, 6).—The aqueous extract of the soot on evaporation gave a very hygroscopic mass; the ammonium salts were sublimed from it, and the residue was lixiviated with water to ascertain the proportion of fixed salts. The numbers obtained were: ammonium sulphate, 0.1; ammonium chloride, 7.3; non-volatile soluble salts, 1.3 per cent. of the original soot. D. A. L.

Krypton. By ALBERT LADENBURG and O. KRÜGEL (*Sitzungsber. K. Preuss. Akad. Wiss.*, 1900, 727—728. Compare this vol., ii, 540).—No simpler method of preparing krypton has yet been found than that already described (*loc. cit.*), and the 32 c.c., or 0.083 gram, isolated from 850 litres of liquid air probably represents the normal proportion of the gas in the atmosphere, which would thus be about 0.00001 per cent. The semi-solid residue from 3 litres of liquid air, when freed from carbon dioxide, nitrogen, and oxygen, gave a residue of argon but no krypton.

The density of the gas when purified by a further fractionation gave the value 59.01 for the molecular weight ($O_2 = 32$), confirming the earlier values and the hypothesis as to the position of krypton in the periodic system. T. M. L.

Action of Chlorine on Metallic Silver in the Light and in the Dark. By V. VON CORDIER (*Monatsh.*, 1900, 21, 655—670. Compare this vol., ii, 343).—Red light does not facilitate the union of chlorine and silver, but blue and violet light favour the combination, although in the latter cases reduction is also accelerated.

Light which has traversed a sufficiently thick layer of chlorine behaves very similarly to red light; the result depends largely on whether the chlorine used for filtering the light is dry or moist; if dry, the action is pretty much the same as when white light is used, but if the light is passed through moist chlorine a considerable diminution in the activity of combination is noticeable. The difference is even greater if a little hydrogen is added to the moist chlorine. Röntgen rays have no perceptible influence on the combination of chlorine and silver. J. J. S.

Some Complex Silver Salts. By KARL HELLWIG (*Zeit. anorg. Chem.*, 1900, 25, 157—188).—Silver iodide and nitrate exist in common solution as a complex salt; this is shown by the lowering of the boiling point due to the addition of the iodide to a solution of the nitrate. The solubility of the iodide in solutions of the nitrate has been determined, and the values obtained have been used in applying the law of mass action to the dissociation of the double salt; in this, experiment agrees fairly well with theory, although the presence of other complex salts than $Ag_3I(NO_3)_2$ seems to introduce a disturbing factor. When this double salt is electrolysed, the silver iodide is found to migrate to the cathode—a case of a complex cation. The solubilities, at 25° in 3*N* silver nitrate solution, of silver iodide,

bromide, chloride, cyanide, and thiocyanate are respectively 9.4, 2.13, 5.6, 9.1, 2.6 millimolecules per litre.

The tendency of insoluble silver salts to form complex anions has also been investigated. The solubility of these salts in the corresponding alkali salts is greatest for the cyanide, followed by the thiocyanate, iodide, bromide, and chloride. The author's observations are in good agreement with Abegg and Bodländer's theory (Abstr., 1899, ii, 542) regarding the formation of complex ions.

The existence of the following double salts in solid form has been confirmed: $\text{Ag}_3\text{I}(\text{NO}_3)_2$, Ag_2INO_3 , Ag_2BrNO_3 , $\text{Ag}_3\text{CN}(\text{NO}_3)_2$, K_2AgI_3 , KAgI_2 , $\text{KAg}(\text{CNS})_2$. The double salt, $\text{Ag}_3\text{CNS}(\text{NO}_3)_2$, has been prepared for the first time.

J. C. P.

Silver Peroxysulphate and Peroxyacetate. By EDUARD MULDER (*Rec. Trav. Chim.*, 1900, 19, 115—165. Compare Abstr., 1896, ii, 561; 1897, ii, 260 and 551; 1899, ii, 483).—The first part of this paper is devoted to a detailed consideration of the preparation and properties of silver peroxysulphate, of which a short account has already been given (Abstr., 1899, ii, 483). The influence of experimental conditions on the yield and purity of the compound is discussed, and the factors of prime importance are shown to be the strength of the current, the concentration of the solution, the rate at which the solution is neutralised during the electrolysis, and the time. Details are then given of the analysis and products of decomposition of a number of different preparations, and some modifications and improvements in the various processes are described. The use of two filters is found advisable, the first containing silver carbonate to neutralise the free acid formed during electrolysis, whilst the second contains silver sulphate, whereby the concentration of the solution is maintained. The formation and decomposition of silver peroxysulphate are theoretically discussed, an analogy is drawn between oxysulphuric and persulphuric acids, and a structural formula for the former is suggested. Remarks are also made on the action of persulphuric acid on hydrogen peroxide, the behaviour of silver peroxide, peroxysulphate, and peroxy-nitrate as oxidising agents, the separation of oxynitric and oxysulphuric acids by dialysis, the rate of spontaneous decomposition of silver peroxysulphate and peroxy-nitrate, experiments on the yield of the latter salt as a function of the time, and the separation of silver nitrate and sulphate by means of alcohol. The general question of the formation of compounds of silver salts of oxoacids with silver peroxide is considered.

In the second part of the paper, an account is given of a preliminary series of experiments on the electrolysis of silver acetate. The most favourable conditions for the formation of the product at the anode are difficult to determine, and the analyses thereof are as yet incomplete, but the production of a compound of the general composition $x\text{Ag}_2\text{O}_3, y(\text{AgOAc}, z\text{O})$, analogous to the peroxysulphate and peroxy-nitrate, is regarded as demonstrated. In the preparation of this substance, silver oxide is found to be better adapted than the carbonate for the neutralisation of the free acid formed. It is suggested that the further investigation of silver peroxyacetate will throw light on

the phenomena of the electrolysis of the salts of organic acids in general. N. L.

Solubility of Calcium Carbonate in Sea-water. By ERNST COHEN and H. RAKEN (*Proc. K. Akad. Wetensch. Amsterdam*, 1900, 3, 63—66).—Artificial sea-water, free from calcium carbonate, was agitated with this substance by means of a current of air, and excess of carbon dioxide subsequently expelled by a current of air free from this gas. In eight days, calcium carbonate corresponding with 53.94 milligrams, and in seventeen days with 57.27 milligrams of combined carbon dioxide per litre, was dissolved at 15°. Sea-water, which contains 52.8—55 milligrams of neutral combined carbon dioxide per litre, must therefore be saturated with calcium carbonate. G. T. M.

Orthoplumbates of the Alkaline Earths. IV. Lead "Peroxide." By GEORG KASSNER (*Arch. Pharm.*, 1900, 238, 449—458. Compare Abstr., 1899, ii, 657).—Calcium perplumbate, already obtained from the metaplumbate, can also be obtained from the crystallised orthoplumbate, $\text{Ca}_2\text{PbO}_4 \cdot 4\text{H}_2\text{O}$, by heating it, best in a current of oxygen, but also in a current of nitrogen or in a vacuum; its formation is due to an intramolecular transformation or oxidation. The temperature employed should be about 260—280°, and the heating should not be continued too long (about 2 hours suffice). C. F. B.

Some Isomeric Halogen Compounds of Thallium and the Constitution of Double Salts. By ALLERTON S. CUSHMAN (*Amer. Chem. J.*, 1900, 24, 222—242).—When thallous chloride is shaken with bromine and water, and afterwards dissolved in boiling water acidified with nitric acid, the compound, $\text{TlClBr}_2 \cdot 3\text{TlCl}$, separates on cooling in orange-coloured, hexagonal plates.

If thallous bromide is suspended in hot water and treated with solution of thallic chloride, the compound, $\text{TlCl}_3 \cdot 3\text{TlBr}$, is deposited in orange, hexagonal plates; under similar conditions, thallous chloride unites with thallic bromide to form an isomeric compound, $\text{TlBr}_3 \cdot 3\text{TlCl}$, which dissolves on boiling, and, if the solution is rapidly cooled, is obtained in blood-red, hexagonal crystals. The former compound is very stable, and can be crystallised from water unchanged; its red isomeride, on the other hand, is very unstable and easily decomposed by water. If the orange compound, $\text{TlCl}_3 \cdot 3\text{TlBr}$, is treated with excess of thallic chloride, the sesquichloride, $\text{TlCl}_3 \cdot 3\text{TlCl}$, is produced, whilst by the action of thallic bromide, long, yellow needles of the double salt, $\text{TlBr}_3 \cdot \text{TlCl}$, are obtained, which on recrystallisation from water are converted into dark red crystals of $\text{TlBr}_3 \cdot 3\text{TlCl}$. In the process of preparing the red compound by the action of thallous chloride on thallic bromide, it was found possible, by varying the dilution, to obtain directly the yellow needles, $\text{TlBr}_3 \cdot \text{TlCl}$, the orange compound, $\text{TlCl}_3 \cdot 3\text{TlBr}$, or the red compound, $\text{TlBr}_3 \cdot 3\text{TlCl}$.

In order to elucidate the constitution of these double salts, determinations were made of the electrical conductivity of solutions of the thallium chlorides and bromides; the results "appear to find a more rational explanation under Werner's hypothesis than under the old linkage theory." E. G.

Preparation and Properties of Neodymium and Praseodymium Carbides. By HENRI MOISSAN (*Compt. rend.*, 1900, 131, 595—600. Compare Abstr., 1896, ii, 422).—*Neodymium carbide*, NeC_2 , prepared by gently calcining a compressed cylindrical mass of neodymium oxide, Ne_2O_3 , and sugar carbon moistened with turpentine until combustible gases are no longer evolved, and then heating the residue for four minutes in the electric furnace by means of a current of 900 amperes and 50 volts, is obtained in the form of yellow, hexagonal plates of sp. gr. 5.15.

Praseodymium carbide, PrC_2 , produced in similar manner by substituting praseodymium oxide, PrO_2 , for the neodymium compound in the above experiment, closely resembles the preceding carbide; it has a sp. gr. 5.10.

These substances are not reduced by hydrogen at a red heat. Nitrogen or ammonia attacks the carbides at 1200° , the former gas forming nitrides and the latter a mixture of hydrides and nitrides; the product in the second case evolves hydrocarbons and ammonia on treatment with water.

When the carbides are greatly warmed in fluorine, a vigorous action takes place accompanied by incandescence; the resulting fluorides are insoluble in water, and somewhat infusible and non-volatile. The halogens act on the carbides only at red heat, the intensity of the action diminishing from chlorine to iodine; the anhydrous haloid salts produced are all soluble in water. A soluble product is likewise obtained by the action of hydrogen chloride at a dull red heat. When heated at 400° in a current of oxygen, neodymium carbide is completely decomposed, leaving a mauve oxide; praseodymium carbide, when similarly treated, yielding a black oxide. Sulphur and hydrogen sulphide, at temperatures between 400° and 1000° give rise to sulphides which are decomposed by water or dilute acids. Carbon readily dissolves in the fused carbides, and the cooled product presents a fracture similar to that of plumbago owing to the presence of graphite crystals.

Water decomposes these carbides as readily as those of cerium, lanthanum, and yttrium, a mixture of gaseous hydrocarbons being evolved, whilst the residue consists of liquid and solid hydrocarbons and hydrated oxides. The composition of the gaseous mixture is very similar in both cases, the gas consisting of acetylene (65 to 68 per cent), olefines (2.5 to 7 per cent.), and paraffins (27 to 30 per cent.). Hot concentrated sulphuric acid is reduced by the carbides yielding sulphur dioxide. Dilute nitric acid rapidly oxidises these compounds, yielding the metallic nitrates; the concentrated acid has no action on them.

The carbides of the cerium group of metals evolve a mixture of hydrocarbons, and differ markedly from those of alkaline-earth series which yield acetylene only, and also from aluminium carbide, which furnishes methane.

G. T. M.

Hydroxides of Aluminium. By EUGENE T. ALLEN (*Chem. News*, 1900, 82, 75—76).—The author is of opinion that precipitated alumina has the composition $\text{Al}(\text{OH})_3$, whether prepared by pre-

precipitating warm or in the cold with ammonia, by boiling a soluble aluminate with ammonium chloride, by boiling the basic carbonate with water or dilute ammonia, or by the prolonged action of water on soluble aluminates. The last form is crystalline and does not lose water over sulphuric acid; the amorphous varieties under such conditions, or by heating at 100° , lose a mol. of water leaving the hydrate, $\text{Al}_2\text{O}_3\cdot\text{H}_2\text{O}$, which is hygroscopic and reverts to $\text{Al}(\text{OH})_3$.

D. A. L.

Action of Caustic Hydroxides on Aluminium. By EUGENE T. ALLEN and H. F. ROGERS (*Amer. Chem. J.*, 1900, 24, 304—318).—On dissolving aluminium in an excess of 10 per cent. aqueous potassium hydroxide, and evaporating the solution in a vacuum over sulphuric acid, the aluminate, $\text{K}_2\text{Al}_2\text{O}_4\cdot 3\text{H}_2\text{O}$ (Fremy, *Ann. Chim. Phys.*, 1844, [iii], 12, 362) separates in hard, nodular crystals; if the alkali is not in excess, hydrolysis of the aluminate occurs and crystalline aluminium hydroxide is deposited, whilst the metal continues to dissolve indefinitely instead of in the proportion demanded by Cavazzi's equation, $2\text{KOH} + 2\text{Al} + 2\text{H}_2\text{O} = \text{K}_2\text{Al}_2\text{O}_4 + 3\text{H}_2$ (Abstr., 1885, 1112).

A solution of aluminium in aqueous sodium hydroxide does not crystallise on evaporation, but on repeatedly digesting with alcohol a hard mass of *sodium aluminate*, $\text{Na}_2\text{Al}_2\text{O}_4\cdot 4\text{H}_2\text{O}$, is obtained. *Lithium aluminate*, $\text{LiHAl}_2\text{O}_4\cdot 5\text{H}_2\text{O}$, obtained in similar manner, is a light, micro-crystalline powder, sparingly soluble in water, by which it is decomposed only after continued boiling; one preparation contained 3 instead of $5\text{H}_2\text{O}$, but an aluminate of a different type could not be obtained.

Aluminium dissolves vigorously in hot concentrated aqueous barium hydroxide, yielding the aluminate $\text{Ba}_2\text{Al}_2\text{O}_6\cdot 5\text{H}_2\text{O}$, as a heavy crystalline, moderately soluble powder, somewhat easily decomposed by water (compare Beckmann, Abstr., 1889, 289 and 649); in the cold, the compound, $\text{BaAl}_2\text{O}_4\cdot 5\text{H}_2\text{O}$ (Beckmann gives $6-7\text{H}_2\text{O}$), is obtained, as a soft, white, apparently amorphous powder, which is easily decomposed by water and by carbon dioxide.

When aluminium is boiled with concentrated, aqueous strontium hydroxide, hydrogen is evolved for a moment, but no further action then occurs; in the cold, the metal dissolves and the *aluminate*, $\text{Sr}_2\text{Al}_2\text{O}_6\cdot 6\text{H}_2\text{O}$, separates. The latter is better obtained by adding a solution of potassium aluminate containing an excess of potassium hydroxide to a hot solution of strontium chloride or hydroxide; it forms a white, heavy, granular, crystalline powder sparingly soluble in water, by which it is only slowly decomposed, and sensitive to the action of carbon dioxide. A second *aluminate*, $\text{SrAl}_2\text{O}_4\cdot 4-5\text{H}_2\text{O}$, closely resembling the second barium aluminate may also be formed in the action of strontium oxide on aluminium, but could not be obtained pure; it forms a glutinous mass.

Calcium aluminate, $\text{Ca}_2\text{Al}_2\text{O}_6\cdot 7\text{H}_2\text{O}$, obtained by dissolving aluminium in lime-water kept saturated with the hydroxide, is a dense, white, crystalline substance, with a pearly lustre; it is only slowly decomposed by water, in which it is very sparingly soluble. On adding aqueous potassium aluminate to hot lime-water, a crystalline

precipitate of the compound $\text{Ca}_3\text{Al}_2\text{O}_6 \cdot 6\text{H}_2\text{O}$ is obtained; it closely resembles the corresponding strontium compound. W. A. D.

Aluminates. By W. HERZ (*Zeit. anorg. Chem.*, 1900, 25, 155—156).—Alkali aluminates of the formula Na_3AlO_6 and K_3AlO_6 are obtained in solution by shaking excess of aluminium hydroxide (prepared by precipitation with ammonia and dried in a vacuum desiccator) with solutions of alkali hydroxides of varying strength.

E. C. R.

Crystallised Monocalcium Aluminate. By ÉMILE DUFAU (*Compt. rend.* 1900, 131, 541—544).—When alumina which has been strongly ignited is heated in the electric furnace with 60 per cent. of its weight of calcium oxide, *calcium aluminate*, $\text{CaO} \cdot \text{Al}_2\text{O}_3$, is obtained in colourless, transparent needles softer than glass and of sp. gr. 3·671 at 20°. It is decomposed by water, but does not "set," and is readily attacked by hydrochloric acid but not by nitric, sulphuric, or hydrofluoric acid. Fluorine attacks it only on heating, but chlorine, bromine, iodine, or sulphur has no action on it at the softening point of glass. When heated with carbon in the electric furnace, it yields two distinct carbides. Attempts to prepare polycalcium aluminates in the electric furnace gave negative results.

It is noteworthy that this calcium aluminate like the analogous beryllium compound, and like calcium chromate and calcium ferrite, does not belong to the group of the spinels. C. H. B.

Iron and Hydrogen. By E. HEYN (*Chem. Centr.*, 1900, ii, 621—622; from *Stahl. u. Eisen*, 20, 837—844).—When cast iron is heated at 730—1000° in contact with hydrogen and then chilled, it becomes considerably more brittle than when similarly heated in air and chilled. If, however, the metal is allowed to cool slowly in hydrogen, it remains tough, and at temperatures below 730° its properties are not affected by hydrogen. A cast iron containing 0·37 per cent. of carbon was found to behave in the same way as one containing only 0·05 of carbon and 0·01 of silicon. By heating the metal in nitrogen at a red heat, the effect of the treatment with hydrogen is destroyed, and in one experiment at a temperature of 820° hydrogen equal to 0·00019 per cent. of the weight of the iron was liberated. In the case of iron containing very little carbon, the brittleness is partly removed by heating in boiling water, or even by long exposure to the air at the ordinary temperature, and is completely destroyed by heating at 200—250°. Iron containing more carbon retains its properties much more obstinately. A superficial layer after treatment with hydrogen was found to show a greater flexibility, hence the hydrogen must penetrate below the surface. The density of the metal is not affected by the treatment with hydrogen. The change cannot be ascribed to silicon taken up from the porcelain tubes in which the metal was heated, for the same result is obtained when iron tubes are employed. E. W. W.

Iron and Steel from the Standpoint of the Phase Rule. By H. W. BAKHUIS ROOZEBOOM (*Zeit. physikal. Chem.*, 1900, 34, 437—487).—The author gives an exhaustive theoretical treatment of

the subject, comparing his conclusions, where possible, with the results obtained by Roberts-Austen and others. In developing the theory, much use is made of the facts recently established in connection with the formation and transformation of mixed crystals. The scheme deduced by the author as representing the equilibria in iron-carbon mixtures of varying composition and at different temperatures can be given only in outline.

Mixtures containing 0—2 per cent. of carbon solidify to homogeneous mixed crystals—martensite; mixtures with 2—4·3 per cent. of carbon solidify to a framework of these mixed crystals, surrounded by a eutectic product, consisting of mixed crystals and graphite; mixtures with more than 4·3 per cent. of carbon solidify to a framework of graphite crystals, surrounded by the eutectic product. On cooling below the solidifying temperature, the alloys with more than 2 per cent. of carbon undergo a separation of carbon between 1130° and 1000°, and at the latter temperature martensite and graphite are transformed into carbide or cementite (Fe_3C); so long as the carbon percentage is less than 6·6, this results in a conglomerate of martensite and cementite. The formation of the latter continues progressively down to 690°; during this interval, the martensite crystals become poorer in carbon, and contain ultimately no more than 0·85 per cent. They disappear at 690° and are transformed into α -iron (or ferrite) and cementite. Any deviations from this normal behaviour are to be regarded as due to unequal rate of cooling; it is certain that with rapid cooling cementite is formed at once, and that in the formation of cementite from the martensite and graphite, a portion of the latter always escapes transformation. Alloys with 2·0—0·85 per cent. carbon separate cementite between 1000° and 690°, resolving themselves at the latter temperature into cementite and ferrite. These changes may, however, fail to take place when the cooling is rapid, in which case the martensite crystals would be permanent. Alloys with 0—0·35 per cent. carbon gradually separate β -iron between 890° and 770°; at 770°, the β -iron is completely transformed into α -iron, and afterwards there takes place a gradual separation of α -iron from the mixed crystals remaining at 770°. Alloys with 0·35—0·85 per cent. carbon separate α -iron only between 770° and 690°. In all alloys with 0—0·85 per cent. carbon, a transformation of the remaining martensite crystals into ferrite and cementite takes place at 690°, although rapid cooling may prevent it. So far as published results go, it is possible to give another scheme of the changes taking place in alloys with 0—0·85 per cent. carbon, on the supposition that carbon is slightly soluble in β - and α -iron. In the author's scheme, a place is found for austenite, which is regarded as a mass of mixed crystals separating themselves from concentrated liquid solutions. Several points in the author's scheme tend to show that carbon is monatomic in solution, but the question is not definitely settled. The question of the diffusion of carbon in iron is also discussed.

J. C. P.

Iron Silicide, Fe_2Si , and its presence in Ferro-silicons. By PAUL LEBEAU (*Compt. rend.*, 1900, 131, 583—586).—Iron silicide,

Fe_2Si , is obtained by strongly heating iron with twice its weight of commercial copper silicide containing 10 per cent. of silicon, the product being treated with nitric acid (1:10) and purified in the usual way. It forms long, brilliant, grey crystals with octahedral terminations. In sp. gr. and chemical properties, it is identical with the silicide obtained by Moissan in the electric furnace (Abstr., 1896, ii, 173), and it can be isolated from commercial ferro-silicons which contain 10 to 20 per cent. of silicon and have been prepared at a high temperature.

C. H. B.

Nickel Selenides. By HENRI FONZES-DIACON (*Compt. rend.*, 1900, 131, 556—558).—*Nickel selenide*, NiSe , is obtained in regular double tetrahedrons by the action of selenium vapour diluted with nitrogen on nickel at a dull red heat, and also by the action of hydrogen selenide on anhydrous nickel chloride at a bright red heat. *Nickel sesquiselenides*, Ni_2Se_3 and Ni_3Se_4 , are obtained by the action of hydrogen selenide on anhydrous nickel chloride at a dull red heat; the compound Ni_3Se_4 is grey and seems to crystallise in the cubic system. *Nickel diselenide*, NiSe_2 , is a dark grey compound formed when hydrogen selenide acts on anhydrous nickel chloride at about 300° . *Nickel subselenide*, Ni_2Se , is a golden-yellow compound obtained by the prolonged action of hydrogen on any of the preceding compounds at a bright red heat. An *oxyselenide* is found when the selenate is carefully heated in dry oxygen.

The selenides are but little affected by boiling hydrochloric acid, but are slowly decomposed by hydrogen chloride at a high temperature. They are readily decomposed by chlorine, and are oxidised by nitric acid with production of selenites, and also by oxygen when heated in that gas.

C. H. B.

Periodic Phenomena in the Dissolution of Chromium in Acids. By WILHELM OSTWALD (*Zeit. physikal. Chem.*, 1900, 35, 33—76).—It has been shown by Hittorf that chromium is remarkable in its behaviour towards acids, assuming an active and a passive state in different circumstances (Abstr., 1898, ii, 363). The author, on investigating further the action of the active chromium on acids, observed a remarkable periodicity in the rate of evolution of the hydrogen, and constructed a self-registering apparatus in order to investigate this property. A piece of passive chromium rendered active by contact with cadmium under acid was dissolved in 2*N* hydrochloric acid; the curve obtained indicated an initial irregular action, which, after about 15 minutes, becomes periodic, the velocity rapidly increasing to a maximum and then falling more slowly to a minimum. The duration of each period was found to increase during the progress of the reaction. Various forms of curves are obtained from different pieces of chromium, and two pieces placed in the same acid were found to give a double summation curve, so the cause of the periodicity lies in the metal and not in the acid. The influence of acid concentration, of temperature, and of foreign substances was studied. Some compounds cause a lengthening of the period, formaldehyde has a remarkably great effect, whilst nitric acid and nitrogen oxides accelerate the periodicity, as also do chloric and bromic acids to a less marked

extent. A piece of almost pure chromium supplied to the author by Goldschmidt did not exhibit these periodic phenomena, neither could it be made active in this respect by treatment with any reagents.
L. M. J.

Constitution of Uranyl Salts. By HEINRICH LEY (*Ber.*, 1900, 33, 2658—2661).—The author has redetermined the conductivities of solutions of uranyl nitrate with specially purified materials, and the results confirm those previously obtained (this vol., ii, 67).

With uranyl nitrate $\mu_{1024} - \mu_{32}$ is 33.4 at 25°, whilst with barium nitrate the corresponding number is 23.1, so that the hydrolytic dissociation of the former in aqueous solution at the dilution 1 : 1024 does not exceed 5 per cent. Dittrich (*Abstr.*, 1899, ii, 629), found the hydrolytic dissociation of uranyl nitrate in 10 per cent. aqueous solution to be 3.6 per cent. at 65°, using the method of cane sugar inversion.

Uranyl salts of strong acids therefore, contrary to the view taken by Kohlschütter (this vol., ii, 484), who regarded the chloride as analogous to acyl chlorides, behave like the corresponding salts of aluminium and beryllium, and are for the most part normally ionised, the radicle UO_2 being the cation.
A. L.

Behaviour of some Halogen Compounds of the Carbon Group analogous to Stannic Chloride. By WL. VON KOWALEWSKY (*Zeit. anorg. Chem.*, 1900, 25, 189—195).—The method of investigation described in a previous paper (this vol., ii, 256), has been applied to titanium tetrachloride and tetrafluoride, and silicon tetrachloride. A solution of titanium tetrachloride in water forms a voluminous precipitate, which dissolves again at the ordinary temperature, without any corresponding change in conductivity. The value of the conductivity points to equilibrium being established before hydrolysis is complete; the hydrolysis is completed by boiling, or by heating in a sealed tube at 150°.

The results show that the tendency to hydrolysis of the tetrachlorides diminishes from tin to titanium and to silicon; the same remark applies to their ability to form complex salts.
J. C. P.

Alloys of Antimony and Tin. By W. REINDERS (*Zeit. anorg. Chem.*, 1900, 25, 113—125).—The freezing point curve for alloys of these two metals has been traced and interpreted; it consists of four branches, the three points of intersection occurring at 8, 20, and 51 per cent. of antimony, and at the temperatures 243°, 310°, and 430°. As found previously by Heycock and Neville (*Trans.*, 1890, 57, 387), the first branch of the curve, starting from pure tin, immediately rises, and there is no eutectic point below the melting point of tin.

These results have been supplemented by an investigation of the microscopic structure of the alloys, the polished sections being etched by electrolytic oxidation in dilute nitric acid. In alloys containing less than 8 per cent. of antimony, mixed crystals of tin and antimony are traced, of the same form as tin crystals. In alloys with 8—20 per cent., cubic crystals are first formed. The crystals characteristic of the third branch of the freezing point curve were somewhat undefined in

form; those of the fourth branch are of the antimony type. In some cases, the crystals first formed could be detected, even though theory required their disappearance under the existing conditions; this is probably due to those crystals getting coated in the rapid cooling, and so being protected from further interaction and transformation.

J. C. P.

Pentachloroplatinic Acid. By ARTURO MIOLATI and I. BELLUCCI (*Atti Real. Accad. Lincei*, 1900, [v], 9, ii, 51—57 and 97—102).—The compound $\text{PtCl}_4 \cdot \text{HCl}_2 \cdot 2\text{H}_2\text{O}$, obtained by Pigéon (Abstr., 1891, 1325) by heating chloroplatinic acid in presence of fused potassium hydroxide, is found to be the intermediate term between chloroplatinic acid and tetrachloroplatinic acid, $[\text{PtCl}_4(\text{OH})_2]\text{H}_2$; it separates as a reddish-brown, deliquescent mass which gives a pale yellow, acid, aqueous solution readily decomposing carbonates in the cold. With ammonia solution, it gives no precipitate, and on heating the liquid it becomes almost colourless. Ammonium and potassium chlorides precipitate the respective platinichlorides. Comparison of the values of the electrical conductivity of solutions of various strengths of the acid with the corresponding numbers for oxalic and hydrofluosilicic acids show it to be dibasic, as also does titration with sodium hydroxide solution. Conductivity experiments also show that one of the replaceable hydrogen atoms of the molecule has a strongly acid character, the other having only weak acid properties. The *sodium* salt, $\text{OH} \cdot \text{PtCl}_5\text{Na}_2$, exists only in solution whilst the *lithium* salt separates in the form of small, yellow needles which are very hygroscopic; the *barium* salt, with $4\text{H}_2\text{O}$, forms long, orange-yellow prisms, and the *silver* salt a yellowish precipitate stable in boiling water; the *thallium* salt and basic *lead* salt, $\text{PtCl}_5(\text{OH})\text{Pb}_2\text{Pb}(\text{OH})_2$, were also prepared.

T. H. P.

Platinum Tetrabromide. By ARTURO MIOLATI and I. BELLUCCI (*Atti Real. Accad. Lincei*, 1900, [v] 9, ii, 140—146).—On mixing solutions of a metallic salt and platinum tetrabromide, salts are precipitated corresponding with tetrabromoplatinic acid, $\text{PtBr}_4(\text{OH})_2\text{H}_2$. The *silver* and *thallium* salts form tobacco-coloured precipitates, the basic *lead* salt, $\text{PtBr}_4(\text{OH})_2\text{Pb}_2\text{Pb}(\text{OH})_2$, a dark brown powder and the *mercury* salt a brown precipitate. The electrical conductivity of solutions of platinum bromide by itself and also when mixed with varying quantities of alkali, shows that tetrabromoplatinic acid is a dibasic acid, and that only one of the replaceable hydrogen atoms is strongly dissociated in solution. The acid dissolves lithium carbonate with evolution of carbon dioxide.

T. H. P.

Behaviour of Rhodium in Alloys with the Noble Metals. By HEINRICH RÜSSLER (*Chem. Zeit.*, 1900, 24, 733—735. Compare Mietzschke, this vol., ii, 371).—When rhodium is cupelled with lead and silver, the button is left with a grey coating of metallic rhodium, which, after removal of the silver, appears as microscopic, six-sided plates and ladder- or star-shaped crystal aggregates. If merely added to molten silver, it floats on the surface of the button and is recovered

in the amorphous state. Rhodium, therefore, does not alloy with silver, and further its density must be less than 12.1.

Rhodium alloys with molten gold, and gives evidence of real combination, an alloy containing 1 per cent. being entirely soluble in aqua regia. A 10 per cent. admixture yields the free metal as feather- or rowel-shaped crystal aggregates, whilst if this limit is exceeded, amorphous rhodium is also found when the button is dissolved in nitro-hydrochloric acid.

Rhodium (2—5 per cent.) added to molten bismuth forms the compound RhBi_4 , which remains after treatment with nitric acid as glistening needles appearing under the microscope as crystalline aggregates. From richer alloys the metal is recovered in a crystalline or amorphous condition, according to the proportion used. If the metals are fused together in the proportions represented by the above formula (12 : 88), the resulting mass is entirely soluble in aqua regia or strong boiling nitric acid, but dilute nitric acid does not dissolve out the bismuth separately.

Iridium behaves like rhodium with silver under the conditions described, but this metal sinks in the button and its crystals are eight-sided. When cupelled with lead and gold, or merely fused with gold, it remains amorphous and shows no solubility in aqua regia.

Small quantities of platinum, in gold ingots (a few parts per thousand) are estimated by boiling out one of two similar cornets with concentrated sulphuric acid; the other with nitric acid. The excess in weight of the first over the second is reckoned as platinum. For larger quantities up to twenty parts per thousand, the second cornet is treated twice. For still larger quantities, the silver is first removed by sulphuric acid, the residue is dissolved in dilute aqua regia (avoiding excess of nitric acid), which leaves any rhodium and iridium behind, whilst the gold in the filtrate is precipitated with ferrous chloride. If ferrous sulphate is used, platinum may be precipitated with the gold.

R. L. J.

Mineralogical Chemistry.

Genesis of some Scottish Minerals. By JOHN GEORGE GOODCHILD (*Proc. R. Physical Soc. Edinb.*, 1900, 14, 181—220).—A speculative paper.

L. J. S.

Cinnabar-bearing Trachyte-tuff from South Tuscany. By JOHAN H. KLOOS (*Zeit. Kryst. Min.*, 1900, 33, 206; from *Zeit. prakt. Geol.*, 1898, 158—163).—A decomposed trachyte from Monte Amiata was found to contain 2.76—5.36 per cent. of mercury. Felspar-sand contained 0.35—54.35, and a kaolin 4.80 per cent. of mercury as cinnabar.

L. J. S.

Manganese Ore from the Amazon District. By FRIEDRICH KATZER (*Zeit. Kryst. Min.*, 1900, 33, 201; from *Oesterr. Zeit. Berg u. Hüttenwesen*, 1898, 46, 41—46).—A manganese ore, consisting princi-

pally of psilomelane, is distributed over an area of 1000 × 500 kilometres in the Amazon district. The purer material occurs in layers with a smooth surface and a reniform structure on one side (anal. I). Other material encloses rock-forming minerals and has a rough surface (anal. II.) with sometimes the appearance of a sandstone (anal. III.)

	MnO.	BaO.	Insol. in HCl.	SiO ₂ .	Al ₂ O ₃ , Fe ₂ O ₃ .	Total.	Sp. gr.
I.	65·73	15·58	6·25	—	—	87·56	3·83
II.	32·05	6·32	55·13	—	—	93·50	3·28
III.	29·14	4·70	—	53·16	5·77	92·77	3·21

L. J. S.

Tin Ores from Banca and Billiton. By RICHARD BECK (*Zeit. Kryst. Min.*, 1900, 33, 205—206; from *Zeit. prakt. Geol.*, 1898, 121—127).—Cassiterite occurs in the islands of Banca and Billiton, Malay Archipelago, as an original constituent in granite, in quartz-veins traversing granite, and in alluvial deposits. A small amount of tin occurs as silicate in the minerals of the granite. The cassiterite in the quartz-veins has probably been collected from the surrounding rock by thermal waters, as is suggested by the occurrence of tin oxide in a siliceous sinter deposited by a warm spring in Selangor. Analysis of this siliceous sinter gave,

SiO ₂ .	H ₂ O.	SnO ₂ .	Fe ₂ O ₃ .
91·8	7·5	0·5	0·2

L. J. S.

Marbles. By J. H. L. VOGT (*Zeit. Kryst. Min.*, 1900, 33, 203—204; from *Zeit. prakt. Geol.*, 1898, 4—16, 43—52).—A detailed discussion from various points of view of marbles (including dolomitic marbles). Several analyses are given.

L. J. S.

Phosphorite [from North Germany]. By W. KOERT (*Zeit. Kryst. Min.*, 1900, 33, 199; from *Jahrb. Preuss. geol. Landesanst.*, for 1898, 1900, 19, cxlvi—cxlix).—Boulders of a middle Miocene rock in the neighbourhood of Tesperhude, below Lauenburg on the Elbe, contain dark brown phosphorite nodules in association with molluscan shells. The nodules consist of sandstone with phosphorite as a cementing material, showing a concentric structure round each quartz-grain. Analysis by Klüss gave I for the rock and II for the nodules. The phosphorite has originated by concentration, around shells, from the surrounding rock.

	Fe.	CaO.	CO ₂ .	P ₂ O ₅ .
I.	2·75	21·17	17·39	0·46
II.	2·84	21·64	3·82	12·73

The remainder consists of silica (quartz and combined silica), water and organic matter, together with traces of aluminium, magnesium and potassium; fluorine is absent.

L. J. S.

Analyses of Minerals from the Langesund Fjord. By HJALMAR SJÖGREN (*Bull. Geol. Inst. Univ. Upsala*, 1900, 4, 227—230).—Analyses by R. Mauzelius are given of minerals from islets in the

Langesund Fjord, Norway, of which crystallographic descriptions have recently been given by G. Flink (*ibid.*, 1899, 4, 16—27). Epididymite (Abstr., 1895, ii, 23) occurs on Lille Arøe associated with eudidymite, ægirite, &c.; analysis I agrees with the formula $\text{HNaBeSi}_3\text{O}_8$. Associated with it is albite (anal. II) of secondary origin. Diaspore from Övre Arøe, occurring as violet-blue scales in the interspaces between crystals of natrolite and also as implanted tabular crystals, gave the results under III (the Al_2O_3 includes traces of Fe_2O_3 and TiO_2).

	SiO_2	Al_2O_3	BeO	Na_2O	K_2O	H_2O	Total.	Sp. gr.
I.	72.04	—	10.22	12.66	0.27	4.51	99.70	2.55
II.	65.99	19.96	—	11.34	1.45	1.04	99.78	2.587
III.	0.21	84.38	—	—	—	15.70	100.29	3.35

L. J. S.

Hardystonite and Zinc-schefferite from Franklin Furnace, New Jersey. By JOHN E. WOLFF (*Zeit. Kryst. Min.*, 1900, 33, 147—151).—A new find of hardystonite (Abstr., 1899, ii, 435) consists of a large mass of almost pure material; this is greyish-white, and gave the analytical results under I. The refractive indices are $\omega = 1.6691$, $\epsilon = 1.6568$ (Na).

	SiO_2	Al_2O_3	Fe_2O_3	ZnO	MnO	CaO	MgO	K_2O	Na_2O	Ign.	Total.
I.	37.78	0.91	0.43	23.38	1.26	34.22	0.26	0.78	1.10	0.34	100.46
II.	52.86	1.08		3.38	5.31	24.48	13.24	—	—	0.45	100.80

Analysis II proves a pyroxene occurring as large, brownish-red platy masses to be a zinc-schefferite. There is a good parting parallel to the basal plane; sp. gr. 3.31. Optical determinations are given in an appendix by G. Melczer.

L. J. S.

Epidote and Zoisite. By PIERRE TERMIER (*Bull. Soc. franç. Min.*, 1900, 23, 50—64. Compare Abstr., 1896, ii, 568; 1899, ii, 303).—A case is described of the occurrence together of the trimorphous minerals epidote, α -zoisite and β -zoisite. The "green rocks" of Mount Pelvas (or Paravas) on the Franco-Italian frontier contain veins and patches of white prehnite in which are embedded prisms of pale green epidote (anal. I by F. Pisani) and fine needles of very pale rose-coloured zoisite (anal. II and III). The zoisite has the optical characters of α -zoisite, but sometimes a little β -zoisite is intergrown with it. At times there are also regular intergrowths of epidote and zoisite, with a definite crystallographic orientation between the two minerals; this indicates that the crystalline structures of epidote and zoisite must be closely related.

	SiO_2	Al_2O_3	Fe_2O_3	MnO	CaO	MgO	K_2O	Na_2O	H_2O	Total.
I.	37.62	28.50	9.30	—	23.20	trace	trace	trace	2.01	100.63
II.	41.44	31.67	0.35	trace	25.03	0.69	0.28	0.41	1.38	101.25
III.	40.92	31.80	0.39	trace	24.92	trace	trace	trace	1.69	99.72

L. J. S.

Chabazites from Sardinia, and from the Granulites of Striegau, Silesia. By CARLO RIMATORI (*Atti Real. Accad. Lincei*, 1900, [v], 9, ii, 146—151).—Analysis of chabazites from the granu-

lites of (I.) Maddalena and (II.) Striegau, and (III.) from the volcanic stone of Montresta give the following results :

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	K ₂ O	Na ₂ O	H ₂ O
I. 48.66	18.32	2.18	5.47	1.56	4.64	19.17	
II. 48.54	16.44	2.93	7.55	3.46	0.11	21.05	
III. 47.96	22.51	—	6.27	2.96	trace	19.68	

T. H. P.

A New Mineral from near Cassel. By MAX BLANCKENHORN (*Zeit. Kryst. Min.*, 1900, 33, 199; from *Jahrb. Preuss. geol. Landesanst.*, for 1897; 1900, 18, iii, 109—129).—In a description of the Muschelkalk in the neighbourhood of Cassel, the following analysis by Klüss is given of an apparently new mineral, honey-yellow to orange-red and yellowish-green in colour, from a sandy, friable oolite :

SiO ₂	Al ₂ O ₃	CaO	MgO	H ₂ O	Organic matter.	Total.
20.71	31.17	1.99	0.07	45.59	0.42	99.95

L. J. S.

Altered Fayalite from the Granulites of Villacidro. By DOMENICO LOVISATO (*Atti Real. Accad. Lincei*, 1900, [v], 9, ii, 10—13).—In heterogeneous veins and nests in the Villacidro granulites are found small masses of a very dark mineral having a hardness between 5 and 6 and a density of 3.984 at 17.2°. Analysis (by C. Rimatori) :

SiO ₂	FeO	Fe ₂ O ₃	MnO	CaO, MgO, Na ₂ O	Total.
28.61	17.55	43.09	8.83	1.09	99.17

This corresponds with the formula, 4Si₂O₉Fe₂, 4Fe₂O₄, 3MnO. It is concluded that the mineral represents an altered form of fayalite, which, however, contains 63.54—65.49 per cent. of ferrous iron, and never more than 5.07 per cent. of manganese.

T. H. P.

Meteoric Irons from Griqualand East, South Africa. By EMIL W. COHEN (*Ann. S. African Museum*, 1900, 2, 9—19).—The "Kokstad" iron in the Vienna Museum gave, on analysis by J. Fahrenhorst, the results under I. A larger mass (298 kilograms) supposed to be from Matatiela in the same district, which has been in the South African Museum since 1885, gave analysis II. Both are octahedral irons with lamellæ of medium width, but they show differences in structure which suggest that they do not belong to the same fall. It is proposed that the latter shall be known as the Matatiela iron.

	Fe.	Ni.	Co.	Cu.	C.	Cl.	P.	S.	Total.	Sp. gr.
I.	91.21	8.01	0.63	0.02	0.03	0.05	0.22	trace	100.17	7.7876
II.	92.20	7.30	0.67	0.03	0.08	0.03	0.19	0.03	100.53	7.8084

L. J. S.

Meteoric Iron from Bethany, Great Namaqualand. By EMIL W. COHEN (*Ann. S. African Museum*, 1900, 2, 21—29).—As there is some confusion in the various irons from South-West Africa, it is proposed to refer to the one often called the great Namaqualand iron (weight about 232 kilograms) as the Bethany iron. The etched

surfaces of this show two portions, one with the normal structure of a finely lamellar octahedral iron, and the other as broad homogeneous-looking bands. Analysis by J. Fahrenhorst of these two portions gave the results under I and II respectively. Sp. gr. 7.8502.

	Fe.	Ni.	Co.	Cu.	C.	Cr.	Cl.	S.	P.	Total.
I.	91.07	8.18	0.63	0.03	0.01	0.02	trace	0.04	0.06	100.04
II.	92.29	7.77	0.57	0.10					0.06	100.79

L. J. S.

New Meteorites from Allegan, Michigan, and Mart, Texas.
By GEORGE P. MERRILL and HENRY N. STOKES (*Proc. Washington Acad. Sci.*, 1900, 2, 41—68).—*Allegan*.—This stone fell at Allegan, Michigan, on July 10, 1899; the total weight was about 70 lbs. It is very friable; sp. gr. 3.905. Chondrules of olivine and of enstatite, sometimes broken and pitted, are set in a confused ground-mass of fragments of olivine and enstatite with metallic iron, troilite, and chromite. This agglomerated structure points to a tuffaceous origin of the meteorite. From analyses of the magnetic portion and of the stony portions soluble and insoluble in hydrochloric acid, the composition of the metal (23.06 per cent. of the whole) is given as; Fe, 91.42; Cu, 0.046; Ni, 7.87; Co, 0.66; Total, 99.996; and of the stony portion as:

SiO ₂	TiO ₂	P ₂ O ₅	Al ₂ O ₃	Cr ₂ O ₃	FeO.	FeS.	MnO.	CaO.
45.42	0.10	0.35	3.31	0.69	11.02	6.57	0.23	2.24
		MgO.	K ₂ O.	Na ₂ O.	H ₂ O.	NiO, Li ₂ O.		
		28.60	0.30	0.86	0.31	traces		

The isolated chromite gave; Cr₂O₃, 50.31; Al₂O₃, 9.67, FeO(Fe₂O₃), 28.78; MgO, 2.76; TiO₂, 1.20.

Mart, Texas.—This iron was found in 1898 and originally weighed 15½ lbs. The structure is octahedral with very distinct Widmanstätten figures. Small amounts of schreibersite, troilite and chromite are present. Analysis gave:

Fe.	Ni.	Co.	Cu.	P.	S.	Cr, Fe ₃ O ₄ .	Total.
89.68	9.20	0.33	0.037	0.158	0.017	traces	99.422

L. J. S.

Physiological Chemistry.

The Influence of Minimal Doses of Suprarenal Extracts on Blood-pressure. By BENJAMIN MOORE and C. O. PURINTON (*Pflüger's Archiv*, 1900, 81, 483—490).—The authors doubt whether the substances separated from the suprarenals are those which cause elevation of blood-pressure. They are less active than the raw extract, and such minute doses of the active physiological substance produce

an effect on blood-pressure that a very small contamination of an inactive substance by the active one will lead to positive effects.

The extract was made from the suprarenals of oxen by extracting them with 10 times their weight of water. This extract was freed from proteid by boiling after acidifying, and then diluted 1000-fold. A more active extract was obtained by precipitating with lead acetate, and subsequently freeing from lead in the usual way. The active substance is in the filtrate, not in the precipitate, and although the filtrate loses by such treatment 75 per cent. of the organic material in the original extract, it is much more active. The filtrate contains the chromogen, and loses its activity slowly on standing. The amount of organic material was estimated in the usual way. As small a dose as 2-millionths of a gram per kilo. of body weight will in the dog produce a considerable rise of blood-pressure. Smaller doses, down to 0.2-millionths, produce a slight rise of pressure, usually followed by a fall. In some animals, the fall was not seen. The question arises whether the fall is caused by another substance, but the probability is that one active substance will produce different effects with different doses.

W. D. H.

Changes in the Substances in the Blood which are Soluble in Ether. By RICHARD WEIGERT (*Pflüger's Archiv*, 1900, 82, 86—100).—The substances present in the blood corpuscles which are soluble in ether diminish in amount by remaining in the warm, although air is excluded. This diminution of the ether extract is accompanied by a rise in the amount of acids soluble in ether. The substance in the blood which is soluble in ether, but diminishes in this way, is not fat, as stated by Cohnstein and Michaelis, and the change should not be described as lipolytic. In the blood-corpuscles and in the blood-plasma, there appears also to be a chemical process which leads to an increase of the ether extract.

W. D. H.

Hydroxylions of the Blood. By RUDOLF HÖBER (*Pflüger's Archiv*, 1900, 81, 522—540).—The alkalinity of the blood is determined by the amount of hydroxyl ions in it. These arise by the hydrolytic splitting of the alkali salts of the weaker acids, especially of carbonic acid. An estimation of the total quantity of these salts gives, therefore, no indication of the alkalinity of the blood. The alkalinity can only be estimated by methods which do not alter the chemical balance there present. It is measurable by electro-chemical methods, and can be calculated from the E.M.F. of a concentration chain for hydrogen ions, or for a chain of hydroxyl ions. The two methods give widely different results. This, however, does not depend on the variability of the dissociation constants of water, but on the fact that the hydroxyl ion chains behave in an irregular manner to the oxygen electrodes used. With hydrogen electrodes, the molecular concentration of hydroxyl ions in defibrinated ox-blood is about $0.1-10^{-5}$.

W. D. H.

Oxidation in Animal Tissues. By AN. K. MEDVEDEFF (*Pflüger's Archiv*, 1900, 81, 540—573).—The experiments recorded are limited to observations on the oxidising action of liver extracts on salicyl-

aldehyde. A previous auto-digestion of the extract for periods varying from 18 hours to 6 days makes no difference to its oxidising power. Oxidation is therefore the result of the interaction of the aldehyde and the active material (oxidation-ferment) in the extract. This action is proportional to the square root of the concentration of the aldehyde, and directly proportional to the concentration of the ferment. It is proportional to the square root of the concentration of the aldehyde, because this is the proportion of that substance which is dissociated in solution. This idea is worked out in great detail and at considerable length, and theoretical views put forward to explain the action of oxidising ferments in particular, and all ferments in general.

W. D. H.

Composition of the Fat of Human Chyle. By FRANZ ERBEN (*Zeit. physiol. Chem.*, 1900, 30, 436—452).—The fat in the urine in a case of chyluria was investigated. This is regarded as equivalent to chyle fat. The following figures give the chief results. Elementary analysis: C, 76.52—76.59; H, 11.88—12.11; O, 11.37—11.55 per cent.; specific gravity, 0.905—0.92 at 15°; melting point, 44°; solidification point, 26°; acid number, 3.508; saponification number, 199.579; ether number, 196.071; Reichert-Meissl number, 2.254; Hehner number, 94.92; iodine number, 54.42; melting point of insoluble fatty acid, 44°.

The fat contains:—Free fatty acids, 1.680; neutral fats, 95.987; lecithin, 0.500; cholesterol, 1.715; glycerol, 10.717; total fatty acids, 95.573; soluble fatty acids, 0.65; insoluble fatty acids, 94.92 per cent. The insoluble fatty acids consist of oleic acid, 58.4; hydroxystearic acid, 6.6; stearic acid, 25.0; palmitic acid, 9.0; myristic acid, 1.0.

W. D. H.

The Properties of Nerve under the Influence of Certain Poisons. By NICOLAI E. WEDENSKI (*Erfüger's Archiv*, 1900, 82, 134—191).—The main properties of nerve investigated were excitability, conductivity, and action-current. The last was detected either by the telephone or galvanometer. Tracings were also taken of the attached muscle. A certain stretch of the nerve was subjected to the local action of certain poisons in solution (cocaine, chloral hydrate, phenol, and chloralose). There is stated to be complete parallelism between the alterations produced of the functional properties of nerve and those in its action-current. Some exceptions to this rule noted in the case of chloralose are only apparent and are due to the extraordinarily rapid return of function which occurs when the action of the poison is suspended.

W. D. H.

Action of Certain Ions on Ventricular Muscle. By D. J. LINGLE (*Amer. J. Physiol.*, 1900, 4, 265—282).—The experiments were performed with strips of the turtle's ventricle, and the results of Loeb's experiments on rhythmic contraction of striped muscle, and gonionemus tissue apply very closely to cardiac muscle. Sodium and not calcium is the stimulus for its rhythmic action, but a pure sodium chloride solution is injurious at last; calcium and possibly potassium salts improve the rhythm by neutralising this injurious

action. Heart-strips will not beat rhythmically in solutions of non-conductors like sugar and glycerol.

W. D. H.

Origin of Glycogen From Proteid. By BERNHARD SCHÖNDORFF [with HEINRICH OFFERGELD] (*Pflüger's Archiv*, 1900, 82, 60—85).—The question whether glycogen can originate after feeding on a diet free from carbohydrates has been frequently investigated, but a critical examination of these researches from those of Claude Bernard's onwards shows that not a single one is conclusive. Either glycogen might have remained over in spite of the previous starvation period, or the diet employed (meat, &c.) was not free from carbohydrate. In the present experiments, frogs were used, and casein was the diet given to them; the result is stated to show with absolute certainty that no glycogen originates from a proteid which does not contain a carbohydrate group.

W. D. H.

Can the Whole of the Glycogen Present in an Organ be removed by Sufficiently Long Extraction with Boiling Water? By JOSEPH NERKING (*Pflüger's Archiv*, 1900, 81, 636—640).—Calf's liver was repeatedly extracted with boiling water until the wash waters were absolutely free from glycogen. The residue was then extracted with dilute potash, when more glycogen was obtained. In the two experiments recorded, the amount of glycogen which was not extractable by water was respectively 24.9 and 76.4 per cent. of the total quantity present. This confirms the view that the glycogen which can be extracted by water is free in the organ, whilst that which cannot, is in chemical combination.

W. D. H.

Origin and Excretion of Oxalic Acid. By ERNST SALKOWSKI (*Chem. Centr.*, 1900, ii, 131—132; from *Berlin. klin. Woch.*, 37, 434—437).—The source of oxalic acid is not proteid, for increase of proteid food (casein) does not produce a rise in oxalic acid excretion, and the acid is not formed from proteid during tryptic or bacterial activity. Calcium oxalate is constantly found in the fæces, and in not unimportant quantities in the bile. The source of oxalic acid is uric acid, and so, indirectly, nuclein; the acid is formed by a process of oxidation. Whether the seat of action is the liver was the subject of some experiments which did not yield satisfactory results. The subject of alimentary oxaluria is also discussed.

W. D. H.

Solubility of Uric Acid in Nucleic and Thymic Acids. By MOTONOSUKE GOTO (*Zeit. physiol. Chem.*, 1900, 30, 473—477).—A fuller account of experiments previously published (this vol., ii, 421).

W. D. H.

Absorption of Free Oxygen by Normal Urine. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1900, 131, 547—552).—Normal urine slowly absorbs oxygen from the air in quantity varying from 8 c.c. to 20 c.c. per litre of urine. There is no alteration in the quantity of urea present, in the proportion of dissolved carbon dioxide, or in the acidity, and the absorption of oxygen seems to be due to, or connected with, the colouring matters or leuco-

colouring matters of the urine. The fact that urine is a reducing agent although formed from arterial blood shows that the function of the kidneys is not purely mechanical. C. H. B.

Acidity of Urine. By MARCELLIN P. E. BERTHELOT (*Compt. rend.*, 1900, 131, 552—553).—The ratio of the acidity of urine as determined with phenolphthalein as indicator to that determined with litmus solution or litmus paper by the spot method, varies considerably. In one case it was 85 : 45, in another 52 : 16, and in another 126 : 14. These ratios are not affected by the absorption of oxygen by the urine. C. H. B.

Estimation of the Acidity of Urine. By OTTO NÄGELI (*Zeit. physiol. Chem.*, 1900, 30, 313—349).—An elaborate investigation by the use of numerous indicators of the various factors which make up the total acidity of the urine. W. D. H.

Excretion of Antipyrine by the Animal Body. By D. LAWROFF (*Ber.*, 1900, 33, 2344—2346).—Antipyrine was administered in doses of 4—10 grams per diem to a full-grown dog weighing 35 kilos. The urine contained a *glycuronic acid*, $C_{17}H_{20}O_8N_2$, of which the crystalline compound of the *barium* salt with barium chloride was analysed. M. O. F.

Hæmolytic Serums. By JULES BORDET (*Ann. Inst. Pasteur*, 1900, 14, 257—296).—The action of hæmolytic serums varies considerably with the kind of animal employed, but in the same serum the alexin which causes destruction of bacteria is identical with the hæmolytic substance. The stromata of the corpuscles manifest towards such alexins a fixative power which is compared with what is seen in the case of staining reagents. It is possible to prepare an antitoxin antagonistic to hæmolytic serum; this is anti-hæmolytic and anti-bactericidal. The action between the two substances appears to be that of chemical neutralisation. W. D. H.

Anti-hæmatic Serums. By PIERRE NOLF (*Ann. Inst. Pasteur*, 1900, 14, 297—331).—A number of experiments on the subject of agglutination are presented, and the mechanism of the process discussed. Mixture of the serum of one animal with that of another often produces a precipitate, but the precipitating agent is not regarded as the agglutinating substance. W. D. H.

Cytotoxins. By ÉLIE METCHNIKOFF (*Ann. Inst. Pasteur*, 1900, 369—377).—**Hæmolytic Serum and Red Corpuscles.** By J. CANTACUZÈNE (*ibid.*, 378—389).—**Leucotoxin.** By BESREDKA (*ibid.*, 390—401).—**Action of Hæmatotoxin on Man.** By ÉLIE METCHNIKOFF and BESREDKA (*ibid.*, 402—414).—The term cytotoxin is introduced for those poisons of animal origin which act on the formed elements (cells, &c.) of organs. The best known example is that contained in serum. The practice of transfusion of an animal's blood into man has been abandoned because of the destruction of the red corpuscles so produced. The main experimental fact brought forward in this series of papers (which relate to the poisons which act, more or less specifically, on the red and white blood corpuscles respectively), is that small doses, instead of producing destruction of the corpuscles in question, act

in a stimulating way so as to lead to an increase in their number. This does not appear to be due to the development of an antitoxin.

W. D. H.

The Gonococcus and its Toxin. By J. DE CHRISTMAS (*Ann. Inst. Pasteur*, 1900, 14, 331—349).—The gonococcus in suitable media elaborates a toxin which, when applied in small doses to the cerebral tissues, produces rapid death. This gonotoxin is not dialysable, it is destroyed at 73°, and is precipitable by ammonium sulphate. If injected subcutaneously, an antitoxin is formed in the blood. The two substances neutralise one another both *in vivo* and *in vitro*. W. D. H.

Relationship between Chemical Constitution and Physiological Action. I. Physiological Action of Alkines of Piperidine. By CESARE PADIERI (*Chem. Centr.*, 1900, ii, 588—589; from *Ann. Farm. Chim.*, 1900, 181—194).—The physiological action of piperylalkine and pipercolylalkine on frogs, rabbits, and dogs is similar to that of piperidine, whilst on the other hand, methylpipercolylalkine exercises a healing influence. Thus the introduction of glycol into the piperidine molecule has no effect on the physiological action, no matter whether the glycol replaces a hydrogen atom of the imino-group or a hydrogen attached to the closed chain. When, however, a hydrogen atom of the piperidine ring is replaced by glycol, and at the same time a hydrogen atom of the imino-group replaced by the methyl group, the physiological action is completely changed. E. W. W.

Chemistry of Vegetable Physiology and Agriculture.

Researches on the Formation of Acetic Acid by Bacteria producing Lactic Acid. By CH. BARTHEL (*Centr. Bakt. Par.*, 1900, [ii], 6, 417—420).—The quantity of acetic acid produced during the lactic acid fermentation of milk varies only slightly with the conditions, the minimum being formed under those which are most favourable for the culture of the bacteria producing lactic acid. Acetic acid may be considered as a pathogenic product of these bacteria.

R. H. P.

Micro-organisms forming Dextran. By F. W. J. BOEKHOUT (*Centr. Bakt. Par.*, 1900, [ii], 6, 161—165).—A new species of *Streptococcus*, named by the author *S. hornensis*, has been isolated from curdled milk, some water samples, and flowers, and has the power of converting media containing up to 20 per cent. of sucrose into a slimy mass with the formation of dextran. Peptone is the most favourable source of nitrogen for the culture of these bacteria, which are capable of producing dextran even in the absence of oxygen.

R. H. P.

Schizomycetic Fermentation. By OSKAR EMMERLING (*Ber.*, 1900, 33, 2477—2479. Compare Abstr., 1899, ii, 569).—A 10 per

cent. solution of milk sugar, when treated with *Bacillus lactis aerogenes* in the presence of calcium carbonate and nutritive salts, becomes turbid and evolves hydrogen and methane; at the same time, a slimy precipitate is produced consisting of a mass of viscid threads. In the presence of atmospheric oxygen the fermentation proceeds until a clear, viscid liquid is formed; at this stage, the filtered solution, on the addition of alcohol, deposits a *galactan*, $C_6H_{10}O_5$; this substance, a white, tasteless powder, reduces Fehling's solution only after hydrolysis with dilute acids, and yields mucic acid on oxidation with nitric acid. Succinic acid is also a product of this fermentation.

Viscid substances are produced in the fermentation of galactose by this bacillus, but their formation is not noticed in the case of dextrose, the latter sugar yielding acetic and inactive lactic acids. Mannitol, under similar conditions, yields large quantities of alcohol and succinic acid, together with traces of the volatile acids. G. T. M.

Chemical and Biological Researches on the Preparation of "Sake." By YOSHINAO KOZAI (*Centr. Bakt. Par.*, 1900, [ii], 6, 385—405).—The preparation of "sake" can be divided into four stages, (i) preparation of the "koji" (the "malt"), (ii) preparation of the "moto" (the yeast), (iii) the fermentation, (iv) the clarification and pasteurisation. The enzyme of the "koji" (*Aspergillus oryzae*) forms dextrose from starch, dextrin, melitriose, sucrose, and maltose, but does not attack inulin or lactose; 2 per cent. of alcohol acts injuriously on the enzyme, which is completely inactive in solutions containing 28 per cent. of alcohol; as, however, during the whole process of the preparation of "sake" there is never more than 18 per cent. of alcohol present, this enzyme must be still active in the later stages of the process. In many samples of "koji" a white mould very similar to Lindner's *Sachisia suaveolens* and *Oidium lactis* is found; it ferments sucrose, raffinose, dextrose, lævulose, or maltose, but not trehalose, rhamnose, lactose, or melizitose. The yeast of sake ferments sucrose, maltose, *d*-mannose, lævulose, dextrose, or methylglucoside very easily, trehalose or *d*-galactose with some difficulty, does not ferment lactose or rhamnose, and splits up melitriose into melibiose and lævulose. R. H. P.

Is the Formation of Enzymes a Trustworthy Characteristic of Yeasts? By ALBERT KLÖCKER (*Centr. Bakt. Par.*, 1900, [ii], 6, 241—245).—The experiments of Dubourg (*Abstr.*, 1899, ii, 376) have been repeated and confirmed. The author disagrees with Dubourg's interpretation of these, and considers that the formation of enzymes is the most trustworthy characteristic of yeasts. R. H. P.

"Chinese Yeast" and the so-called Amylomycetes (*Mucor Rouxii*). By CARL WEHMER (*Centr. Bakt. Par.*, 1900, [ii], 6, 353—365).—"Chinese yeast," a preparation used in East Asia for starting the fermentation of rice, contains a mould, *Mucor Rouxii*, which can be cultivated in solutions of lævulose, dextrose, galactose, sucrose, lactose, maltose, or inulin with peptone or ammonium nitrate, alcohol being formed in every case. R. H. P.

Nitrification in the Soil of Forests. By W. MIGULA (*Centr. Bakt. Par.*, 1900, [ii], 6, 365—370).—Nitrites and nitrates are not found except in minute quantities in the soil of forests. The author describes experiments in which such soil was inoculated with organisms which produce nitrites and nitrates. Nitrification did not take place in the upper layers, which contained decomposing leaves, but only in the deeper layers, zones of increasing intensity of nitrification being formed, which were different from the similar zones formed in arable land. The formation of nitrites, however, proceeded much more quickly in the cultures than the formation of nitrates.

R. H. P.

Occurrence and Action of Proteolytic Ferments in Germinated Seeds. By WL. BUTKEWITSCH (*Chem. Centr.*, 1900, ii, 386—387; from *Ber. deut. bot. Ges.*, 18, 185—189. Compare Green, *Abstr.*, 1887, 987, and Neumeister, *ibid.*, 1894, ii, 290).—The results of the author's experiments confirm those of Green (*loc. cit.*) in showing the presence in germinated seeds of a proteolytic enzyme which, like "animal trypsin," decomposes proteids with production of amides. An enzyme of this kind seems to be present in the axillary organs of seedlings of *Lupinus luteus*, and also (perhaps as zymogen) in ungerminated seeds of *L. angustifolius*.

Among the products of decomposition, substances were present which yield ammonia when boiled with dilute hydrochloric acid as in Sachsse's method for estimating asparagine or glutamine.

N. H. J. M.

Proteolytic Ferments of Germinating Seeds. By V. HARLAY (*Compt. rend.*, 1900, 131, 623—626. Compare this vol., i, 511, 576; ii, 35, 233, 301).—Germinating lentil seedlings are extracted with water and chloroform and the filtered extract tested with the tyrosinase derived from *Russula delica*. The freshly-prepared solution remains colourless, but after a fortnight's digestion either alone or with casein, it gives a marked coloration, the liquid becoming red and then brown. If the solution is boiled before the addition of casein, the colour reaction is considerably diminished. It is found that the boiled solution has a solvent action both on the casein and the coagulated albumin.

These results point to the existence of tyrosine in the plant at the commencement of the experiment, a further quantity of this substance being formed during digestion at the expense of either the vegetable proteid matters or the casein. Hence the proteolytic ferment of the germinating lentil is analogous to the trypsin of animal tissues, since it gives rise to similar products during the digestion of proteids.

G. T. M.

Germination and Growth of Peas in Solutions of Salts of Fatty Acids. By OSKAR LÖVINSON (*Chem. Centr.*, 1900, ii, 344, and 388—389; from *Bot. Centr.*, 83, 1—12, and 33—43).—Instead of the usual nutritive solutions, the author employed solutions containing all the necessary bases in the form of formates, acetates, and propionates respectively. Nitrogen was present in the form of the

corresponding ammonium salt, sulphur as carbon disulphide, and phosphorus in the free state dissolved in water (1 : 50,000).

The results of the germination experiments showed that the salts of fatty acid retarded germination; the percentage numbers of seeds which germinated were 77.5 in formates, 66.66 in acetates, and 10 in propionates. Carbon disulphide promoted germination, but somewhat influenced the subsequent development. Phosphorus only retarded germination slightly.

The solutions of formates and acetates (but not propionates) proved to be very favourable to the growth of fungi and bacteria.

N. H. J. M.

Germination and Growth of Peas in Solutions of Salts of Fatty Acids. By OSKAR LÖVINSON (*Chem. Centr.*, 1900, ii, 681—682; from *Bot. Centr.*, 83, 209—224).—The plants grown in solutions of [salts of] formic acid lived on an average 52 days, whilst those in solutions of acetic or propionic acid lived 28 and 17 days respectively. The injurious effects of the compounds seemed to be diminished by gradually accustoming the plants to stronger solutions. The plants after becoming inured to solutions of [salts of] formic acid would doubtless be able to assimilate mineral and organic nutriment provided that the strength of the solutions had been such as to prevent the emptying of the cotyledons; this also applies to the other acids with certain limitations. The great length of life (80 days) and vigorous growth of plants grown in solutions of formates, prove that the plants are capable of obtaining their sulphur from carbon disulphide and of assimilating phosphorus directly, and that the alkalis and alkaline earths do not require to be present in the form of salts of mineral acids.

E. W. W.

Proteid Metabolism in Plants. By ERNST SCHULZE (*Zeit. physiol. Chem.*, 1900, 30, 241—312).—A large number of observations on the chemical composition of different parts of various plants at different ages are recorded. They are carried out on the lines of the author's previous work, and confirm the views he had advanced concerning proteid metabolism. The proportion between the amounts of proteid decomposition products (amino-acids, hexon bases, &c.), varies at different stages. The most marked change is a diminution in the quantity of leucine, tyrosine, and the simpler amino-compounds, and the simultaneous increase of asparagine, and in some cases glutamine also, as age advances. The theory that the proteids break up into asparagine and a carbohydrate is not confirmed. Asparagine appears to be easily utilised for proteid synthesis.

W. D. H.

Material for Plant Nutrition in Apples and Pears. By EDUARD HOTTER (*Chem. Centr.*, 1900, ii, 484—485; from *Zeit. landw. Vers. Wes. Ost.*, 1900, 583—585).—By suitably manuring fruit trees their lives are prolonged, and weak trees strengthened. Analyses of 20 kinds of apples and pears showed that for every 100 kilograms of fruit about 70 grams of nitrogen, 35 of phosphoric oxide, 170 of potassium oxide, and 14 of lime are withdrawn from the ground. Fresh apples yield about 0.336 per cent. of ash, and contain 0.076 of

nitrogen, whilst pears give 0.301 of ash and 0.069 of nitrogen; calculated on the dry substances, these data become, for apples, 2.24 and 0.47 per cent. respectively, and for pears, 2.01 and 0.46. The following analyses of the ash of apples and pears are quoted, the figures in brackets referring to the pears: SiO_2 , 1.08 (1.55); SO_3 , 2.49 (5.02); P_2O_5 , 10.42 (11.92); Fe_2O_3 , 1.18 (0.98); CaO , 4.22 (4.73); MgO , 3.71 (4.29); K_2O , 51.58 (52.88). E. W. W.

Myrosin. By THOMAS BOKORNY (*Chem. Zeit.*, 1900, 24, 771—772).—The presence of myrosin in plant substances may be conveniently proved by observing whether the addition of potassium myronate to about 1 gram of the material triturated with 5 c.c. of water at 30—40°, and contained in a small stoppered flask, develops the odour of mustard-oil within the course of 48 hours. Myrosin was thus detected in the seeds (except where otherwise stated) of the following plants. An asterisk denotes that potassium myronate or a glucoside which yields mustard-oil is already present.

Cruciferae:—*Black mustard, white mustard, summer radish (*Raphanus sativus*), roots also, **Iberis amara*, **I. umbellata*, **I. sempervirens*, *scurvy grass (*Cochlearia* off.), *winter cabbage (*Brassica oleracea*), red, white, curly, and turnip cabbages, wallflower (*Cheiranthus cheiri*), summer-stock, and *watercress (*Nasturtium* off.).

Leguminosae:—Bean (*Phaseolus vulgaris*), lentil, pea, and vetch.

Umbelliferae:—Carrot (*Daucus carota*), tap-root, and parsley, root.

The following gave negative results, the part tested being mentioned:

Compositae:—Herbage of *Aposeris foetida*, seeds of *Artemisia dracunculus* (possibly present), and leaf of elecampane (*Inula helenium*).

Various:—Herbage of pæony and spurge (*Euphorbia cyparissias*), young fruit of lime, fruit and seed of maple, herbage and blooms of soapwort (*Saponaria* off.), *Borago salvia* off., and *Campanula rotundifolia*, seeds of pine and sea-pine, the inflorescence, leaf and stem of houseleek (*Sempervivum tectorum*), vegetative part of stone-crop (*Sedum acre*), and a young rhubarb leaf, also the onion, leek, and ripe beans.

R. L. J.

Bitter Principles of Hops. By GEORG BARTH (*Chem. Centr.*, 1900, ii, 681; from *Zeit. ges. Brauw.*, 23, 509—513).—A sample of commercial lupulin gave 18.27 per cent. of ash, 63.93 of material soluble in ether, and 36.07 of lupulin husks. The portion soluble in ether contained 0.18 per cent. of wax, 11.55 of α -resin, 43.31 of β -resin, 0.17 of ash, and 8.72 of fat, oil, γ -resin, &c. The portion insoluble in ether contained 15.31 of ash insoluble in hydrochloric acid, 2.75 of ash soluble in hydrochloric acid, 4.78 of proteid substances, 2.34 of pentosans, and 10.89 (by difference) of non-nitrogenous substances, tannins, fibres, &c. The substances extracted by ether or light petroleum did not contain nitrogen. The quantity of sand in commercial lupulin varies from 10.9 to 20.2 per cent. E. W. W.

Adlumia Cirrhosa—A New Protopine-bearing Plant. By JULIUS O. SCHLOTTERBECK (*Amer. Chem. J.*, 1900, 24, 249—253; and *Ber.*, 1900, 33, 2799—2801).—The root of *Adlumia cirrhosa* (climbing

fumitory) contains about 1 per cent. of protopine, whilst the leaves contain much less. Fumarine is probably identical with protopine, and since fumarine was discovered and named long before its discovery in opium by Hesse, the author is of opinion that the name protopine should be abandoned.

E. G.

An Alcornoco Bark known commercially as Jaborandi, and Alcornoco Barks in general. By C. HARTWICH and E. DÜNNEN-BERGER (*Arch. Pharm.*, 1900, 238, 341—352).—A “jaborandi bark” imported from Venezuela in 1888, was found, by botanical examination, to belong in reality to a species of alcornoco; it contained 16.6 per cent. of tannin. Further, several varieties of alcornoco barks were examined botanically, and, to a certain extent, chemically. In particular, from a specimen of bark denominated *Cort. Alcornoco*, the alcornin of Biltz, Frenzel and Spigatis was isolated. This melts at 205°, and has a specific rotation +33.83°; a number of its colour reactions are described. It has the formula $C_{22}H_{34}O$, and it yields a *monoacetyl* derivative; consequently, it is an alcohol of the nature of phytosterol, and is better named *alcornol*.

C. F. B.

Astragalus Caryocarpus. By GEORGE B. FRANKFORTER (*Chem. Centr.*, 1900, ii, 484; from *Amer. J. Pharm.*, 72, 320—325).—The unripe fruit of *Astragalus caryocarpus* has a bitter taste, which is probably due to the presence of an alkaloid, whilst the ripe fruit, on the other hand, has a peculiar, sweet taste. From the latter, a disaccharose, *astragalose*, has been obtained in the form of a grey hygroscopic powder. It melts at 95—98°, reduces Fehling's solution, has a rotatory power $[\alpha]_D +38.5^\circ$, and yields a phenylhydrazone melting at 186—188°. Analysis of the latter showed it to be a hydrazone of a hexose. The rotatory power and properties of the sugar are, however, easily affected by change of conditions.

A substance which contains nitrogen and gives the reactions of an alkaloid was also isolated from the plant extract.

E. W. W.

The Sea-weed *Ulva Latissima* and its Relation to the Pollution of Sea-water by Sewage. By EDMUND A. LETTS and JOHN HAWTHORN (*Chem. News*, 1900, 82, 164—165).—*Ulva latissima*, or sea lettuce, contains C, 35.15; H, 5.27; N, 6.25; O, 37.96; ash, 15.37 (in which is S, 3.21; Fe, 2.20) per cent., and when fermented yields hydrogen, carbon dioxide, propionic, butyric, and, probably, acetic acids; later, the mass blackens from the ferrous sulphide formed, and hydrogen sulphide is disengaged. The weed abounds in polluted waters, and can thrive in and assimilate large quantities of nitrogen from sea-water charged with sewage and ammonia or nitrates; probably this is the cause of the high percentage of nitrogen in the plant. It is suggested that the presence of the weed in large quantities may perhaps be regarded as evidence of sewage contamination.

D. A. L.

Toxic Action of Acid Sodium Salts on *Lupinus Albus*. By LOUIS KAHLLENBERG and ROLLAN M. AUSTIN (*J. Physical Chem.*, 1900, 4, 553—569).—The toxic powers of solutions of acid sodium salts and of acids are compared by means of determinations of the concentra-

tions of solutions in which seedlings of *Lupinus albus* will just live. The acid sodium salts exert a far greater toxic influence than would be expected from the concentration of the hydrogen ions, and the authors hence conclude that the dissociation theory is unsatisfactory in explaining the toxic action of these acid salts. L. M. J.

Digestibility of some Non-nitrogenous Constituents of certain Feeding Stuffa. By G. S. FRAPS (*J. Amer. Chem. Soc.*, 1900, 22, 543—552).—According to Ladd (*N. York Agric. Expt. Stat. Geneva Rep.*, 1889, 149), the sucrose and reducing sugars present in lucerne and mixed hay, wheat bran, maize, cotton seed, and linseed meals and oats are completely digested; in turnips fed with mixed hay the reducing sugars were completely digested, but of the sucrose only 78.7 per cent. was digested.

The results of the experiments now described showed that as a rule the sugars are completely digested. The examination of twenty-three samples of excrement obtained in digestive experiments showed that neither sucrose nor dextrose was present; some of the samples contained reducing substances, but these do not seem to be sugars.

The results of Stone's experiments on the digestibility of pentosans (*Agric. Science*, 7, 6) in various foods (grasses, hay, sugar-beet, wheat bran, &c.) indicated that the average digestibility is 60.3 per cent. (compare also Lindsay and Holland, *ibid.*, 8, 172).

The author has determined the total pentosans, and also the pseudo-pentosans (that is, the constituents of the crude fibre which yield furfuraldehyde) in several foods, and also their digestibility. From 0 to 21 per cent. of the pentosans consists of pseudo-pentosans, and in four out of five cases the pseudo-pentosans are less digestible than the pentosans of the non-nitrogenous extract.

Of the nitrogen-free extract, 53 to 15 per cent. consists of sugars and pentosans. In the case of cow-pea meal, maize bran, and rice bran, the remainder of the extract consists of starch, which is more digestible than the pentosans; in the case of timothy hay and crab-grass hay, the order of digestibility is sugars, pentosans, residue.

As regards the crude fibre, the pseudo-pentosans are less digestible than the residue. It seems probable that the crude fibre and undigested non-nitrogenous extract decompose in the intestines with production of gases, of soluble substances which are resolved, and of insoluble products which pass into the excrement and, being soluble in acid and alkali, appear in the analysis as non-nitrogenous extract. This would make the digestibility of the non-nitrogenous extract seem less, and that of the crude fibre greater than is actually the case.

Attention is called to the importance of determining sugar in foods, and especially in hay and cotton seed meal. The determination of starch and pentosans is also of more importance than that of the crude fibre. N. H. J. M.

Rye as Food. By WOLDEMAR VON KNIERIEM (*Chem. Centr.*, 1900, ii, 394—396; from *Landw. Jahrb.*, 29, 484—523).—Crushed rye in conjunction with clover hay only slightly increases the yield of milk, but the rye seemed to have no injurious effect on the cows. When cows receive sufficient fat (in oil cake), rye increases the yield

of milk rather more than oats; the amount of fat in the milk was diminished by rye.

In experiments with sheep, it was found that with the exception of the non-nitrogenous extract, the constituents of rye are less digestible than those of oats; the fat in rye is very slightly digested. Pigs consume rye very unwillingly after some time, and exclusive feeding with rye causes illness, from which, however, the pigs rapidly recover when fed with barley. Rabbits and poultry object to rye. Rabbits digest much of the non-nitrogenous extract, but not the proteids.

On the whole, rye may be advantageously employed for feeding if used with care, and in conjunction with sufficient digestible fat.

N. H. J. M.

Vetch Corn as Food. By WOLDEMAR VON KNIERIEM (*Chem. Centr.*, 1900, ii, 396; from *Landw. Jahrb.*, 29, 524—540).—Crushed vetches considerably increased the yield of milk, but diminished the amount of fat in the milk. No injurious effect was observed during six years.

Rabbits digested vetches well, and the constituents showed higher digestion-coefficients than those of the various cereals.

Pigs object to vetches alone, and soon cease to gain in weight. This is attributed mainly to the high amount of proteids.

As regards the taste of milk and butter, the results obtained with vetches were satisfactory; no bitter taste was noticed. N. H. J. M.

Feeding Cows with Cane Sugar. By EBERHARD RAMM (*Bied. Centr.*, 1900, 601—602; from *Milch Zeit.*, 1899, 673).—As in the other feeding experiments (following abstracts), the cows received during each period: hay, 14; straw, 4·5; roots, 50; and brewers' grains 4 kilos. per 1000 kilos. of live weight. In addition, they received earth-nut cake and cane sugar respectively (6 kilos.). The rations contained the following amounts of digestible substances per 1000 kilos. live weight; earth-nut cake ration: proteid, 4·12; fat, 0·93; and non-nitrogenous matters, 13·48. Sugar ration: proteid, 1·70; fat, 0·54; and non-nitrogenous matters, 15·65.

The sugar had no injurious effect on the health of the cows. As compared with earth-nut cake, it increased the live weight by about 1 per cent., diminished the yield of milk per day by 0·86 kilo., and the yield of milk fat and milk dry matter by 0·058 and 0·133 kilo. respectively.

N. H. J. M.

Feeding Cows with Maize Gluten. By EBERHARD RAMM (*Bied. Centr.*, 1900, 29, 600—601; from *Milch Zeit.*, 1899, 658).—The results of feeding experiments showed that, like maize bran (this vol., ii, 39), maize gluten, as compared with earth-nut cake increased the yield of milk. The percentage composition of the maize gluten was found to be as follows: nitrogenous matter, 35·90; fat, 1·85; non-nitrogenous extract, 31·80; crude fibre, 16·00; ash, 1·20; and water, 13·25.

N. H. J. M.

Feeding Cows with Malt-germ Molasses. By EBERHARD RAMM (*Bied. Centr.*, 1900, 29, 599—600; from *Milch Zeit.*, 1899, 641).—Under the conditions of the experiments, malt-germ molasses

was shown to be a suitable substitute for the same weight of earth-nut meal. The malt-germ molasses contained : nitrogenous matter, 14.60 ; fat, 3.85 ; non-nitrogenous extract, 47.15 (including sugar, 25.05 ; crude fibre, 4.40 ; ash, 6.35 ; and water, 23.05 per cent. (compare this vol., ii, 502).

N. H. J. M.

Non-saccharine Matter contained in Molasses. By EBERHARD RAMM and C. MOMSEN (*Chem. Centr.*, 1900, ii, 489 ; from *Milch Zeit.*, 1900, 433—436).—The effect of the non-saccharine portion of molasses when used as food was investigated by feeding five milch cows with the following series of foods. (1) Residual molasses containing about 41 per cent. of sugar ; (2) the corresponding amount of raw sugar ; (3) an equal quantity of raw sugar with the non-saccharine mud obtained in the process of removing sugar from molasses ; (4) residual molasses as in (1). In addition to these, a good basal ration was used throughout the experiments. The molasses-mud was used as a substitute for the ash, nitrogenous and other non-saccharine components of the molasses. By making the fourth period like the first and using the same rations, the effects due to decreasing lactation were eliminated from the calculations. During the raw sugar period the milk was found to contain less fatty matter, whilst in the third period it increased by as much as 71 grams of butter fat per day per 1000 kilograms of body weight, and the milk had at this time the highest specific gravity. The quantity of milk remained about constant in the first three periods and then decreased.

E. W. W.

Beans. By TÁMAS KOSUTÁNY, RICHARD WINDISCH, E. VON HÉRICHS-TÓTH, LADISLAUS VON SZÉLL and ADOLF FALTIN (*Landw. Versuchs-Stat.*, 1900, 54, 463—479).—Analyses are given of Hungarian and French beans (compare Ballard, this vol., ii, 174) ; the results indicate that the Hungarian beans are the more nutritive, containing more proteids and carbohydrates, and less cellulose than the French beans.

Bean oil, extracted by ether resembles olive oil in appearance. The oil, dried over sulphuric acid, has the following properties : Sp. gr., 0.9670 ; Hehner number, 78.5 ; Reichert-Meissl number, 2.46 ; Köttsedorfer number, 135.4 ; iodine number (Hübl), 119.9 ; refraction at 25° and 40°, 81.5 and 72.5 respectively. The oil contains fatty acid triglycerides, much lecithin and a good deal of sulphur.

N. H. J. M.

Cork Oak. By EMILIO TASSELLI (*Bied. Centr.*, 1900, 29, 615—617 ; from *Staz. sper. agrar. ital.*, 1899, 32, 209).—The results of analyses are given showing the amounts of ash, and of ash constituents, in the cork, wood, roots, leaves, and fruit of the cork-oak. As regards the fact that large amounts of nitrogen and mineral matter are taken from the soil and that no manure is required, the results of calculations are given showing that, notwithstanding the large amounts of cork and wood removed, only one-tenth of the total supply of the soil would be utilised in 1200 years.

N. H. J. M.

Hemp. By M. SAMOGGIA (*Bied. Centr.*, 1900, 29, 602—604 ; from *Staz. sper. agrar. ital.*, 1898, 31, 353).—Pot experiments are described

in which hemp was grown in ignited sand watered with (a) Nobbe's solution containing chlorine, and (b) Knop's solution containing no chlorine, but more nitrate than (a). In the first stages of growth, when the chlorine of the seeds sufficed, the plants watered with Knop's solution grew best, but subsequently they became unhealthy. The total weight of air-dried plants were (a) 28.5 and (b) 42.0 grams. The separated fibre contained (a) 90.149 and (b) 88.470 per cent. of dry matter of the following percentage composition :

	Organic matter.	Cellulose.	Crude fat.	Reducing sugar.	N.	Ash.
a.	91.43	53.36	2.02	3.90	1.658	8.57
b.	88.85	37.00	2.83	7.98	2.465	11.15

The ash contained (per cent.):

	K ₂ O.	CaO.	P ₂ O ₅ .	SiO ₂ .	Cl.
a.	36.27	15.62	9.67	5.95	1.38
b.	30.85	5.33	10.79	6.33	0.59

Müntz and Girard showed that application of chlorides increased the cellulose and diminished the ash and reducing sugar.

Maceration during six days did not cause loss of pentoses and pentosans.
N. H. J. M.

Cultivation of Parsnip. By HENRI GUÉPIN (*Ann. agron.*, 1900, 26, 476—477; from *J. Agr. prat.*, 1900, i, 527).—The yield of parsnip varies from 30,000 to 60,000 kilos. per hectare. The percentage composition is as follows: Dry matter, 15.3; nitrogenous matter, 1.4; fat, 0.2; non-nitrogenous extract, 11.6; and cellulose, 1.2. As regards feeding value, the results indicate that parsnip is superior to mangolds, turnips, and carrots.

As indicated by the composition of the ash, parsnip requires abundance of phosphoric acid, potash, and lime.

Parsnip is suitable for feeding horses, cows, and bullocks.

N. H. J. M.

Effect of Different Potassium Salts on the Composition and Yield of Potatoes. By THEODOR PREIFFER (*Landw. Versuchs-Stat.*, 1900, 54, 379—385. Compare Abstr., 1898, ii, 306).—A reply to Sjollema (this vol., ii, 305), in which the author shows that Sjollema's results are not opposed to, but confirm, his own, which indicated that the injurious action of "crude salts" was due to the presence of magnesia. Other results obtained by Sjollema lend support to the author's view that the different degrees of injury by potassium chloride on the yield of starch do not accord with the amount of chlorides found in the potatoes, but depend rather on the variety of the potato.

N. H. J. M.

Soil Investigations in the Tokay Wine District. By BÉLA VON BIRÓ (*Landw. Versuchs-Stat.*, 1900, 54, 337—348).—Determinations of carbon dioxide, from which the calcium carbonate is calculated, were made in a large number of Hungarian soils. The results, as well as descriptions of the physical properties of the soils, are given in tables.

N. H. J. M.

Practical Conclusions from [the Results of] Soil Analyses. By P. DOERSTLING (*Bied. Centr.*, 1900, 29, 586—588; from *Fühling's Landw. Zeit.*, 1899, 184).—The soils were extracted (1) for 24 hours with water at the ordinary temperature, (2) for 6 hours with water at 50—55°, (3) for 6 hours with water through which carbon dioxide was passed, and (4) for 24 hours with 5 per cent. citric acid. The samples were collected in the spring after autumn application of (A) dung and (B) green manure. The following percentage amounts of the total potash, calcium carbonate, and phosphoric acid were dissolved by the different solvents.

	A. Farm-yard manure.			B. Green manure.		
	K ₂ O.	CaCO ₃ .	P ₂ O ₅ .	K ₂ O.	CaCO ₃ .	P ₂ O ₅ .
Total per cent.	0.1645	0.611	0.1198	0.2185	0.418	0.1552
Per cent. of total.	{ 1. 15.0 2. 22.9 3. 23.9 4. 64.4	{ 3.8 8.4 20.9 76.6	{ 21.7 34.1 31.4 46.4	{ 13.5 15.5 18.7 65.0	{ 6.9 13.1 24.4 72.7	{ 15.0 12.8 21.3 38.2

Analyses are given of soil before and after the application of lime and green manure, both together and separately. The results accord in some cases, but not always, with the yields of crops.

Analyses of soils growing healthy and diseased roots showed that the disease was not due to deficiency of nutritive matters in the soil.

N. H. J. M.

Composition of some Manure-soils. By LEOPOLD KOURIMSKY (*Bied. Centr.*, 1900, 29, 595—597; from *Zeits. landw. Versuchswes. Oesterr.*, 1899, 2, 580).—In the north-west of Bohemia various deposits, derived, it is supposed, from ancient Celtic dwellings and cemeteries, are employed as manures. The following percentage results were obtained from three deposits in Postelberg:

	Stones.	Soil.	Water.	Loss on ignition.	N.	K ₂ O.	CaCO ₃ .	P ₂ O ₅ .
1.	7.1	92.9	4.00	7.44	0.168	0.687	5.52	1.408
2.	3.9	96.1	9.80	7.22	0.196	0.908	3.64	1.344
3.	—	—	8.35	6.23	0.134	0.54	15.50	1.20

The results of analyses of muds from ponds and rivers are also given.

N. H. J. M.

Manurial Experiments. By JOSEF HANAMANN (*Bied. Centr.*, 1900, 29, 591—594; from *Zeit. landw. Versuchswes. Oesterr.*, 1899, 2, 573).—From the results of 35 years' experiments in pots and beds, the conclusion is drawn that it is possible to obtain quite normal plants in pots, and that such experiments furnish results of practical importance.

The results of some vegetation experiments, which are given in detail, indicated that when loss of nitrate by drainage is impossible, the nitrogen left after the first year will increase the yield of barley considerably.

The analytical results show that the composition of the barley grown in pots was normal, whilst as regards the size of the grain and the

relation of grain to straw, no essential difference was observed in the pot plants as compared with those grown in the field.

N. H. J. M.

Manurial Experiments with Vegetables. By RICHARD OTTO (*Bied. Centr.*, 1900, 29, 588—591; from *Gartenflora*, 1899, 48, 563).—Lettuce. The best results as regards yield and quality were obtained with farmyard manure. Sodium nitrate and kainite, both separately and mixed, do not seem favourable to the production of solid heads.

The order of yield in the case of kohl-rabi, after the various manures, was (1) farmyard manure, (2) compost, (3) sodium nitrate and superphosphate, (4) sodium nitrate and kainite, (5) sodium nitrate, superphosphate and kainite, and (6) sodium nitrate. Non-nitrogenous manures alone did not greatly increase the yield as compared with the unmanured plot. Analyses of the plants obtained under the influence of the various manures are given. The percentage of nitrogen in the dry matter varies from 3 (without manure and with superphosphate alone) to 5.42 (with farmyard manure). The ash contained K_2O , 27.61 to 44.33; CaO , 8.84 to 12.32; and P_2O_5 , 12.80 to 16.26 per cent.

N. H. J. M.

Distribution of Manures. By BERTHAULT (*Ann. Agron.*, 1900, 26, 417—430).—In 1884, a field which had been manured with 30,000 kilos. of farmyard manure per hectare received in addition 200 kilos. of sodium nitrate. On one portion of the land the nitrate was sown broadcast and on two other portions it was distributed along the furrows, and in holes 40 cm. apart along the lines. The yield of roots on the three portions of the field was as follows: Nitrate sown broadcast, 21,785; in the furrows, 38,392; and in holes, 40,337. Whilst the localisation of manures must depend on the nature of the manures themselves and on the crop, it is thought that the system may be generally adopted with advantage (compare Schloesing, *Abstr.*, 1893, ii, 141).

N. H. J. M.

Methods of Experiments on the Preservation of Farm-yard Manure. By THEODOR PFEIFFER, F. MOSZEIK, and OTTO LEMMERMANN (*Landw. Versuchs-Stat.*, 1900, 54, 349—378).—The conflicting results hitherto obtained in experiments on the preservation of stable manure are, at any rate in part, attributed to imperfect methods. The method now proposed is based on the fact that the nitrogen supplied in the food is completely recovered in the excrement after deducting the amount deposited in the body and that of the milk wool, &c. The composition of the food and of the materials used for litter is therefore determined, as well as the composition of the fæces, urine and milk. By determining ash constituents (phosphoric acid and potash), the amounts of which remain of course unaltered, it is possible to ascertain how far the nitrogen results can be depended on. An important point which has to be considered is the extent of the loss of nitrogen in the manure before it is removed from the stalls (compare Müntz and Girard, *Compt. rend.*, 1892, 115, 1318, and 116, 108).

As regards the foods to be employed, mangolds and lucerne are to be

avoided. The authors propose meadow hay, dried beetroot sections and crushed earth-nut cake, with straw for litter. The whole quantities of hay and straw required for the experiment are prepared beforehand and sampled.

After describing the stalls and the arrangements for the solid and liquid manure, the sampling of the manure, and the analytical methods employed, the authors give in tables a number of results which show that the taking of samples can be made sufficiently accurate and that the feeding of the animals and the collection of the products can be conducted without loss.

N. H. J. M.

Street-dust as Manure. By ADOLFO CASALI (*Bied. Centr.*, 1900, 29, 583—586; from *Staz. sper. ital. agrar.*, 1898, 31, 377).—Street-dust is recommended as manure by Strabo, Pliny, and Columella, and it was highly valued during the middle ages. The results of analyses of a sample of sifted street-dust collected during a dry September show that the material is suitable for soils poor in lime. It is also of use for the purpose of mixing with nitrogenous manures, both as a diluent and to enable them to be uniformly distributed; in the case of superphosphate, street-dust would be of use in diminishing the acidity.

The author considers that street-dust is also of use in supplying a great variety of microbes, derived partly from rain and partly from excrementitious matters.

N. H. J. M.

Analytical Chemistry.

***p*-Nitrophenol as an Indicator.** By LEOPOLD SPIEGEL (*Ber.*, 1900, 33, 2640—2641. Compare Langbeck, *Chem. News*, 1881, 43, 161, and Wieland Abstr., 1883, 1167).—The author recommends a 2—5 per cent. alcoholic solution of *p*-nitrophenol in place of methyl-orange in ordinary acidimetry and alkalimetry. The change from yellow when alkaline to colourless when acid is very marked, and the indicator is quite indifferent towards carbon dioxide. Sodium ammonium phosphate and crystallised borax may be estimated by the aid of the same indicator, but not fused borax.

J. J. S.

Wide Occurrence of Indicators in Nature. By G. S. FRAPS (*Amer. Chem. J.*, 1900, 24, 271—276).—The author has examined extracts of a large number of coloured flowers, leaves and fruits, and has found that, as a rule, the colouring matters are fairly sensitive as an indicator, giving one colour when acid and another when alkaline.

E. G.

Abegg and Herz's Method for the Separation and Recognition of Acids. By WILHELM FRESSENIUS (*Zeit. anal. Chem.*, 1900, 39, 566—574).—With regard to Abegg and Herz's systematic scheme

(this vol., ii, 436), the author objects that the same necessity does not exist with acids, as with bases, to separate them one from another before they can be identified, and that many of the reactions used by Abegg and Herz are untrustworthy. For instance, neither cyanogen nor arsenious acid is precipitated by calcium chloride under the conditions defined. Tartaric acid is only precipitated completely by calcium chloride when time is allowed for it to crystallise. The precipitate is then very sparingly soluble in acetic acid, and may be easily mistaken for calcium oxalate. Calcium phosphate exhibits a similar behaviour with acetic acid. Boric acid finds no place in the scheme, and the difficulties resulting from the presence of silicates are not provided for. Other objections can be advanced to the methods advocated for the detection of the halogens and nitric acid, and on the whole the scheme has but little practical value. M. J. S.

Estimation of Potassium Perchlorate in Alkali Nitrates (Nitre and Chili Saltpetre). By N. BLATTNER and J. BRASSEUR (*Chem. Zeit.*, 1900, 24, 767).—Five grams of the dried sample are mixed with 7 to 8 grams of pure calcium hydroxide and heated in a covered platinum or porcelain crucible for 15 minutes over a Bunsen burner. When cold, the mass is transferred to a measuring flask marked at 128 c.c. and extracted for an hour with water. After making up to the mark (3 c.c. is taken as the volume of the undissolved matter), the liquid is well shaken and filtered through a dry filter. One hundred c.c. (4 grams of sample) of the filtrate are carefully neutralised with dilute nitric acid using methyl-orange as indicator, and the chlorine is then titrated with silver nitrate as usual. After allowing for the percentage of chlorine present as chloride, the balance is calculated into potassium perchlorate. L. DE K.

Process for the Estimation of Chlorides, Chlorates, and Perchlorates in the Presence of each other By N. BLATTNER and J. BRASSEUR (*Chem. Zeit.*, 1900, 24, 793).—The chlorine as chloride is first estimated as usual. It is then again estimated after reduction of any chlorate by boiling with sulphurous acid and finally after ignition with calcium hydroxide (see preceding abstract).

The authors have not as yet found any chlorate in samples of saltpetre. L. DE K.

Estimation of Potassium Iodide. By THOMAS S. BARRIE (*Pharm. J.*, 1900, [iv], 11, 58).—When potassium iodide (5 grams in 20 c.c. of water) containing chlorides and bromides is treated with 5 per cent. solution of potassium dichromate (10 c.c.) and 10 per cent. sulphuric acid (10 c.c.), iodine alone is liberated. This is extracted with toluene or carbon disulphide, the solution shaken with a known volume of $N/10$ sodium thiosulphate solution and the excess titrated with standard iodine. R. L. J.

Simple and Accurate Method for Estimating the Dissolved Oxygen in Fresh-water, Sea-water, Sewage Effluents, &c. By EDMUND A. LETTS and ROBERT F. BLAKE (*Chem. News*, 1900, 82, 163—164).—An ordinary separating funnel is filled with the water to be examined and a measured volume withdrawn; a definite volume of

standard ferrous sulphate solution, containing about 48 grams per litre, is added, and then ammonia, the combined volume of these two reagents being equal to the volume of the water removed. The stopper is inserted with the exclusion of air-bubbles, and the liquids are mixed together. After 15 minutes, the funnel is inverted, the stem filled with a mixture of equal volumes of sulphuric acid and water, the tap opened, and when all the iron hydroxide is dissolved the solution is titrated with permanganate or dichromate.

D. A. L.

Estimation of Oxygen in Copper by Ignition in Hydrogen. By LEONARD ARCHBUTT (*Analyst*, 1900, 25, 253—262).—Blount (Abstr., 1896, ii, 333) has described a process based on the reduction of copper oxide by hydrogen. The sample is melted in a current of dry hydrogen and the water collected and weighed. The author whilst acknowledging the accuracy of this process prefers to estimate the oxygen by the loss in weight which the sample suffers when ignited in hydrogen as has already been proposed by Hampe. Thirty to forty grams of the copper, best in the form of bright turnings small enough to pass through a tube $\frac{1}{8}$ -inch in diameter, are thoroughly cleansed with ether, dried, and introduced into a dry weighed bulb tube, which is then reweighed. The whole is ignited for about an hour in a current of purified hydrogen, and then allowed to cool in the current. When cold, the hydrogen left in the bulb tube is displaced by dry air and the tube reweighed.

An illustration of the apparatus and bulb tube is given.

L. DE K.

Detection of Free Phosphorus. By P. MUKERJI (*J. Asiat. Soc. Bengal*, 1900, 69, ii, 97—101).—The author has noticed that hydrogen generated in contact with free phosphorus becomes phosphorescent.

The incompletely oxidised compounds of phosphorus yield, like phosphorus itself, a gas which burns with a green flame, but this is not luminous in the dark. The glow is lessened to some extent by the presence of much alcohol, ether greatly interferes with it, but is soon expelled, oil of turpentine stops it and should be first got rid of by washing the material with alcohol and then with water. Nitrous fumes, hydrogen sulphide, iodine, and oil of mustard in moderate quantities do not interfere.

The apparatus in its simplest form consists of a flask fitted with a tap funnel and a jet. Common zinc and dilute sulphuric acid are introduced, and after making sure that the reagents cause no glow, the suspected article is added and the effect observed in a dark room.

L. DE K.

Estimation of Phosphorus in Coke and Coal. By J. M. CAMP (*Chem. News*, 1900, 82, 8—9).—The coke, powdered to pass through a 40-mesh sieve, is dried at 100° for an hour, and when cool 5 grams are exposed in a porcelain crucible in a muffle overnight; the contents are, next morning, transferred to a platinum crucible, supported on a platinum tripod, on the top of the chimney of an Argand burner, and heated below boiling with 5 c.c. of dilute hydrochloric acid (1:2), and 10 c.c. of dilute hydrofluoric acid until dry,

further dried, but not baked, allowed to cool, and warmed with 15 c.c. of the dilute hydrochloric acid. The contents are transferred to an evaporating dish, boiled for one or two minutes with 5 c.c. of strong nitric acid, filtered, treated with 25 c.c. of strong ammonia, then with sufficient strong nitric acid to exactly dissolve the precipitate, after which 5 c.c. more is added. Precipitation with molybdate follows, &c., and 1.63 per cent. of the dried precipitate is taken as phosphorus.

D. A. L.

Estimation of Phosphorus in Ores, Pig-iron, and Steel containing Arsenic. By J. M. CAMP (*Chem. News*, 1900, 82, 9).—Five grams of pulverised dry ore are gently boiled for 30 minutes with hydrochloric acid, the solution diluted, filtered, and exposed on a steam-bath overnight. In the morning, 2 grams of pure oxalic acid and 50 c.c. of hydrochloric acid are added, the solution covered with a watch glass, taken to dryness sharply, but not baked, then, when cool, evaporated with 30 c.c. of strong hydrochloric acid until the first appearance of insoluble ferric chloride, treated with 10 c.c. of strong nitric acid, and when violent action has ceased, warmed to complete solution, diluted, and filtered into a flask, washing with 2 per cent. nitric acid. The portion of the ore insoluble in hydrochloric acid is ignited, fused with mixed carbonates, dissolved in excess of hydrochloric acid, allowed to dry overnight in a steam-bath, moistened with dilute hydrochloric acid and enough hot water to dissolve chlorides, warmed, filtered, added to the contents of the other flask, and the phosphorus determined in the whole, in the manner described in the preceding abstract. The method is applicable to the analysis of pig-iron and steel.

D. A. L.

Estimation of Phosphorus in Steel, &c. By FRED IBBOTSON and HARRY BREARLEY (*Chem. News*, 1900, 82, 55).—A solution of 2 grams of the steel in 45 c.c. of nitric acid of sp. gr. 1.2 is treated with permanganate until a pink colour or a precipitate of manganese dioxide persists on boiling; it is cleared with ferrous sulphate and after the addition of 4 c.c. of strong ammonia is shaken while hot with 30 c.c. of molybdate reagent, then kept at 70–80° for a few minutes, passed through a pulp filter, and washed. The precipitate is dissolved in ammonia, treated with 10 to 12 c.c. of hydrochloric acid and 10 c.c. of a solution of lead acetate (40 grams to the litre), heated and well shaken with a mixture of 10–12 grams of ammonium chloride and 50 c.c. of strong ammonium acetate solutions; the precipitate is filtered and weighed as lead molybdate. The process is applicable (with slight modifications) to pig-irons, nickel-steels and alloys, chromo-steels, tungsten-steels, spiegels and ferro-manganese (compare *Abstr.*, 1899, ii, 337).

D. A. L.

Estimation of Phosphoric Acid as Phosphomolybdic Oxide. By H. C. SHERMAN and HENRY ST. JOHN HYDE (*J. Amer. Chem. Soc.*, 1900, 22, 652–658).—The solution representing 0.2–0.5 gram of the sample of phosphate is mixed with 25 c.c. of strong ammonia of sp. gr. 0.9; after neutralising with nitric acid, 5 to 8 c.c. of acid of sp. gr. 1.42 are added in excess. The solution is diluted to 150 c.c., heated to 50° and a 3 per cent. solution of ammonium molyb-

date slowly added with constant stirring until there are about 20 c.c. in excess. After 10 minutes, the liquid is decanted through a porcelain Gooch crucible, and the precipitate is washed thrice by decantation with 50—70 c.c. and then on the filter with 200—250 c.c. of cold 1 per cent. nitric acid. Finally, the precipitate is ignited by placing the crucible inside a nickel crucible and heating the bottom of the latter to a dull red heat for 15 minutes as directed by Woy (Abstr., 1898, ii, 138) and weighed as the oxide, $P_2O_5 \cdot 24MoO_3$. L. DE K.

Adulteration and Analysis of Arsenical Insecticides. By JOHN K. HAYWOOD (*J. Amer. Chem. Soc.*, 1900, 22, 568—582; 705—706).—The author calls attention to the adulterations of arsenical insecticides. These are readily detected by the usual methods.

As regards the *bona fide* articles they may be assayed as follows. Water may be determined in Paris or Scheele's green by drying for 12 or 15 hours at 100°. The total arsenious oxide is best estimated by the iodine process recommended by Smith (this vol., ii, 47). A good method for estimating copper in these substances is to titrate the iodine set free from potassium iodide in an acetic acid solution.

In order to completely extract free arsenious oxide from Paris green, a very large amount of water is necessary. The author finds that 500 c.c. of water dissolve an appreciable quantity of the arsenical copper compound, and that, therefore, the amount of free arsenious oxide found will be in excess of the truth (compare next abstract).

The amount of arsenious oxide, combined with the dissolved copper oxide, may be readily calculated from the amount of the latter. One part of copper oxide corresponds with 1.875 parts of arsenious acid.

A large number of analyses are communicated.

L. DE K.

[Estimation of] **Free Arsenious Oxide in Paris Green.** By EUGEN W. HILGARD (*J. Amer. Chem. Soc.*, 1900, 22, 690—693).—The author states that, on account of the slight solubility of octahedral arsenious oxide, the quantity of water used to dissolve the free arsenious oxide from 1 gram of Paris green should be raised to 600 or, preferably, 1000 c.c., and the extraction continued for 24 hours (compare preceding abstract.) The use of the microscope is recommended for the rapid detection of decided quantities of free oxide.

L. DE K.

Qualitative Test for Boric Acid. By E. M. WADE and M. L. WADE (*J. Amer. Chem. Soc.*, 1900, 22, 618).—About 0.1 gram of the substance to be tested for boric acid is put into a test-tube 2.5 cm. in diameter, and 20 cm. long; 0.5 c.c. of hydrochloric acid, and 10 c.c. of methyl alcohol are added, and the mixture is rapidly boiled down to a small bulk by moving the lower end of the tube in the flame of a burner, and holding the moistened end of a piece of turmeric paper just outside the mouth in contact with the evolved vapour. If boric acid is present, the turmeric will turn a characteristic red, which is coloured pink, or deep purple, or blue when moistened with very weak ammonia.

L. DE K.

Estimation of Potassium by Phosphomolybdic Acid. By WAVELET (*Chem. Centr.*, 1900, ii, 689—690; from *Ann. Chim. anal. appl.*, 5, 289).—The precipitate which sodium phosphomolybdate gives

with potassium salts contains potassium and phosphoric acid in the invariable ratio $K_2O/P_2O_5 = 1.99$, although the amount of molybdenum may vary. To prepare the reagent, 140 grams of sodium carbonate, 20 grams of ordinary sodium phosphate, and 70 grams of freshly ignited molybdenum trioxide are dissolved together in 500 c.c. of water, 200 c.c. of nitric acid are added, the solution made up to a litre and filtered after 24 hours. To estimate potassium, an excess of the reagent is added, the mixture evaporated to dryness, the residue rubbed to powder, heated with dilute nitric acid (1:10), and, after cooling, the precipitate collected and thoroughly washed with dilute nitric acid. The phosphoric acid in it is then estimated in the usual way with magnesia mixture, but the ammonium magnesium phosphate may be titrated instead of being ignited. It is dissolved in nitric acid, and the solution neutralised with ammonia; 1 c.c. of acetic acid and some sodium acetate are added, and then a standard solution of lead nitrate (35 grams per litre) until a drop gives a yellow colour with potassium iodide.

M. J. S.

Shortened Method for Estimating Potassium in its Salts. By HUGO NEUBAUER (*Zeit. anal. Chem.*, 1900, 39, 481—502).—The following process, if strictly adhered to in every detail, gives an accurate estimation of potassium in a solution which may contain sodium, magnesium, calcium, chlorides, and sulphates: Twenty-five c.c. of the aqueous solution of the substance (0.5 gram) are mixed with a few drops of hydrochloric acid and a small excess of platinic chloride, and evaporated on the water-bath just to dryness. After cooling, the mass is moistened with 1 c.c. of water and well rubbed with a pestle made from glass rod; 30 c.c. of alcohol are then added in portions of 10 c.c. at a time, rubbing very intimately after each addition. After half an hour, the precipitate is transferred to an asbestos filter in a platinum Gooch crucible, and thoroughly washed with strong alcohol (93—96 vols. per cent.) and finally with ether. The contents of the crucible are next reduced by very gradual heating in hydrogen, or equally well in coal-gas (5 minutes below red heat and 20 minutes at a very dull red), and then thoroughly washed with hot water. The crucible is then filled with 5 per cent. nitric acid, which is allowed to act for half an hour, returning it as it slowly percolates through the filter. The reduced platinum is again thoroughly washed with hot water, dried, ignited, and weighed. Multiplication by 0.48108 gives the corresponding weight of potassium oxide. Should barium be present, the reduction must not be performed with coal-gas, but with hydrogen; with this exception, the process needs no alteration, and equally good results are obtained.

M. J. S.

Detection of Sodium Carbonate in Milk. By P. Süss (*Chem. Centr.*, 1900, ii, 596; from *Pharm. Centr.*, 41, 465).—As little as 0.05 gram of sodium carbonate in 100 c.c. of milk can be detected by the rose-red coloration produced on adding a 0.2 per cent. alcoholic solution of alizarin.

M. J. S.

Estimation of Free Alkali in Soaps. By R. E. DIVINE (*J. Amer. Chem. Soc.*, 1900, 22, 693—695).—The author has modified

Dudley and Pease's process, titration of the free alkali by means of $N/10$ alcoholic stearic acid, so as to avoid the troublesome filtration of the alcoholic solution of soap from any undissolved alkali carbonate.

Two grams of undried soap are introduced into a round-bottomed flask, 50 c.c. of alcohol and a definite number of c.c. of $N/10$ alcoholic stearic acid, more than sufficient to neutralise any alkali present, are added, and also a little phenolphthalein. After boiling for half an hour under a reflux condenser, the excess of stearic acid is titrated with $N/10$ alcoholic soda and the total amount of alkali calculated.

Another 2 grams of the sample are boiled with 50 c.c. of alcohol, a 10 per cent. solution of barium chloride is added in quantity just sufficient to decompose the alkali found, and the liberated barium hydroxide is then titrated with $N/10$ alcoholic stearic acid and phenolphthalein, the result being expressed as free alkali.

The difference between the two titrations represents alkali carbonate.

L. DE K.

New Volumetric Method for the Estimation of Silver. By LAUNCELOT W. ANDREWS (*Amer. Chem. J.*, 1900, 24, 256—266).—The process is a modification of the one introduced by Pisani for the estimation of very small quantities of silver by means of a solution of iodine containing starch.

The silver solution should contain not quite 5 per cent. of nitric acid and be free from mercury and the lower oxides of arsenic and antimony; any nitrous acid should be expelled by boiling, and sulphurous acid must be removed by addition of ferric sulphate. A solution of ferrous sulphate is added in such quantity that there shall be at least as much iron as silver, and an equal quantity of iron as ferric sulphate is also added; if the amount of silver should be more than 0.02 gram per 100 c.c., it is best to first convert the iron sulphates into nitrates by judicious addition of strontium or lead nitrate.

The starch-iodine solution is then run in from a burette until the colour of the liquid turns slightly blue, showing that all the silver is precipitated. This solution is best prepared by heating 9 grams of pure iodine and 50 grams of purified maize-starch with 100 c.c. of water in sealed tubes for an hour in a boiling water-bath. When cold, it is diluted to a convenient strength, say a $N/20$ or $N/100$ solution. This should be standardised with silver nitrate; estimation of the iodine by means of sodium thiosulphate would give erroneous results.

L. DE K.

Gravimetric Estimation of Zinc as Sulphate. By WILHELM EULER (*Zeit. anorg. Chem.*, 1900, 25, 146—154).—The estimation of zinc as sulphate is sufficiently accurate for ordinary work. The zinc solution, which must contain only sulphuric acid or acids which are volatile in the presence of sulphuric acid, is evaporated to dryness in a weighed platinum crucible and the residue cautiously heated at a dull red heat to constant weight. The result may be confirmed by decomposing the sulphate over the blow-pipe and weighing as zinc oxide.

E. C. R.

Lead and Cadmium Ferrocyanides. By EDMUND H. MILLER and HENRY FISHER (*J. Amer. Chem. Soc.*, 1900, 22, 537—543).—The authors confirm Gay Lussac's statement that lead ferrocyanide always retains more or less potassium ferrocyanide from which it cannot be freed by washing. A number of experiments have shown that the amount of potassium increases with the acidity of the liquid, it being just the same whether there is an excess of lead or ferrocyanide. The results also agree closely with Low's statement (*Abstr.*, 1893, ii, 437) that a solution containing 10 grams of crystallised potassium ferrocyanide per litre equals 0.01 gram of lead per c.c.; Furman has stated that 16 grams should be taken, but this figure is no doubt based on the erroneous conclusion that the formula of lead ferrocyanide may be calculated from that of zinc ferrocyanide.

Cadmium ferrocyanide thrown down from an ammoniacal solution has a composition agreeing with Hermann's formula $\text{CdK}_2\text{Fe}(\text{CN})_6$, but when precipitated from an acid solution, its composition lies between that formula and the one proposed by Wyruboff, $\text{K}_5\text{Cd}_5[\text{Fe}(\text{CN})_6]_4$. This fact is also confirmed by Mackay (this vol., ii, 49), who states that it requires about 2.5 per cent. less potassium ferrocyanide to precipitate cadmium than would be required by the formula $\text{CdK}_2\text{Fe}(\text{CN})_6$. The results again contradict Furman's statement that the cadmium standard may be calculated from the zinc standard.

L. DE K.

Analysis of Lead and Tin Ores, also of the most important Lead and Tin Preparations, and their Commercial Products. By H. MENNIOKE (*Chem. Centr.*, 1900, ii, 399; from *Zeit. öffentl. Chem.*, 6, 227—235. Compare this vol., ii, 688).—Galena may be assayed by reducing 0.5 to 1 gram of the sample with 30 c.c. of dilute hydrochloric acid (1:3) and 1 gram of granulated zinc in a platinum basin. If a glass vessel is used, 2 grams of zinc must be taken. The reduced mass is collected on a weighed filter, dried and weighed; the lead is then extracted by means of dilute nitric acid, and the residual gangue weighed; the metal may, of course, also be estimated in the filtrate as sulphate.

Other lead ores and compounds may be assayed in a similar manner.

L. DE K.

Analysis of Lead and Tin Ores, also of the most important Lead and Tin Preparations and their Commercial Products. By H. MENNIOKE (*Chem. Centr.*, 1900, ii, 594; from *Zeit. öffentl. Chem.*, 6, 266).—Cassiterite cannot be completely dissolved by hydrochloric acid and zinc, so must be fused with soda and sulphur. The stannous tin in stannous chloride may be estimated by adding an excess of ferric chloride, and titrating the ferrous salt by permanganate; the total tin, by reduction with hydrochloric acid and zinc. Granulated tin is washed repeatedly with water, and then boiled with an excess of ferric chloride, or it may be dissolved in concentrated hydrochloric acid, precipitated with zinc, redissolved, oxidised with chlorate, and, after expelling chlorine, precipitated by ammonium nitrate. Tin-bronze, mosaic silver, mosaic gold, and similar products may be reduced with zinc and hydrochloric acid, noting that 2.2 milligrams of tin remain unprecipitated by zinc.

M. J. S.

New Volumetric Method for the Estimation of Copper. By SAMUEL W. PAER (*J. Amer. Chem. Soc.*, 1900, 22, 685—689).—The solution which contains the copper in the state of nitrate should also contain a small quantity (not exceeding 1 per cent.) of free nitric acid. The metal is now precipitated by heating on the water-bath and adding sulphurous acid and a slight excess of potassium thiocyanate. When the precipitated cuprous thiocyanate has completely subsided, it is collected on an asbestos filter and well washed. The asbestos is returned to the beaker and the whole heated to 70° with a few c.c. of 10 per cent. aqueous sodium hydroxide. Standard potassium permanganate is then added in amount sufficient to completely oxidise the cuprous oxide, shown by the liquid assuming a permanent green tint; excess of dilute sulphuric acid (1:5) is added, and when the liquid has become clear the titration is completed at 70°. Seven mols. of potassium permanganate represent 10 atoms of metallic copper. L. DE K.

Estimation of Copper Sulphate. By MARIO ZECCHINI (*L'Orosi*, 1899, 22, 372—376).—For the rapid valuation of copper sulphate for agricultural purposes, the author recommends a method based on the reduction of the salt by means of excess of sodium thiosulphate, the cuprous salt formed being then precipitated by ammonium thiocyanate and the excess of thiosulphate determined by titration with iodine solution. Details are given of the method, which gives results in good agreement with those obtained by electrolysis. T. H. P.

Volumetric Estimation of Corrosive Sublimate in Dressings. By F. UTZ (*Chem. Centr.*, 1900, ii, 690; from *Pharm. Zeit.*, 45, 626).—The author modifies Lehmann's method (this vol., ii, 443) as follows: 100 c.c. of the solution, prepared in the usual way, are mixed with 5 to 10 c.c. of hydrogen peroxide and excess of *N*/100 alkali. The mixture is shaken, gently warmed, and the excess of alkali titrated. The reaction is $\text{HgCl}_2 + 3\text{H}_2\text{O}_2 + 2\text{KOH} = \text{Hg} + 2\text{KCl} + 2\text{O}_2 + 4\text{H}_2\text{O}$. Correction must be made for any acidity of the hydrogen peroxide. M. J. S.

Estimation of Aluminium. By EUGENE T. ALLEN and V. H. GOTTSCHALK (*Amer. Chem. J.*, 1900, 24, 292—304).—The precipitate obtained by decomposing sodium or potassium aluminate with carbon dioxide is a basic aluminium carbonate of approximately the composition $\text{OH} \cdot \text{AlCO}_3 \cdot 7\text{Al}(\text{OH})_3 \cdot 9\text{H}_2\text{O}$, contaminated with small quantities of alkali carbonate; the latter is completely removed on boiling with water containing a little ammonium chloride or nitrate, the precipitate changing in this process to the hydroxide. The latter, prepared in this way, is dense and can be filtered and washed much more rapidly than the hydroxide precipitated by ammonia. The following method of estimating aluminium is more rapid than the old one, whilst at least as accurate.

The substance is dissolved either in water or a mineral acid, in the latter case the excess of acid being nearly neutralised with ammonia; a solution of 1 to 2 grams of potassium hydroxide, in which the amount of silica, iron, and alumina is known, is then added until

the precipitate first formed is redissolved ; an excess of alkali should be avoided. Carbon dioxide is then passed in until precipitation is complete, 20 minutes, as a rule, sufficing for 0.2 gram of alumina ; the precipitate is for the most part transferred to a filter paper, washed with water, and then washed back into the original beaker, where it is boiled for 2 to 3 minutes with 150—200 c.c. of water containing a little pure ammonium chloride or nitrate. After settling, the precipitate is collected on a filter-paper, using a pump and cone, washed by decantation with hot water, burned, and, after heating for 10 minutes in the blowpipe flame, weighed ; the hygroscopic nature of alumina renders it necessary to heat again, after the first approximate weighing, and weigh very rapidly.

The method is as accurate as the old one for iron and alumina occurring together, and, with a large proportion of the latter, is preferable ; it is accurate in the presence of sulphates, whilst the old method gives high results. When, however, alkaline earths or lithium are present, it is not applicable.

W. A. D.

Estimation of Alumina as Phosphate in Ore and Blast-furnace Cinder. By J. M. CAMP (*Chem. News*, 1900, 82, 9—10).—A gram of the ore or cinder is treated for silica, and the cold hydrochloric acid filtrate is diluted to about 400 c.c. and treated with 30 c.c. of a 10 per cent. solution of ammonium phosphate and then with ammonia until a faint precipitate forms ; 1.5 c.c. of strong hydrochloric acid are added, and for ores 50 c.c., for cinder 30 c.c. of a 20 per cent. solution of sodium thiosulphate. The mixture is heated to boiling, 8 c.c. of strong acetic acid and 15 c.c. of 20 per cent. solution of ammonium acetate are added, and the whole boiled for 10 minutes, allowed to subside, the clear solution decanted, precipitated, filtered, and washed on the filter with hot water 10 times, but not more, as aluminium phosphate is slightly soluble. The precipitate is ignited in a platinum crucible in front of the muffle until the paper chars, then finished in the hottest part ; 41.85 per cent. of the weight is alumina.

D. A. L.

Relative Values of the Mitscherlich and Hydrofluoric Acid Methods for the Estimation of Ferrous Iron. By WILLIAM F. HILLEBRAND and HENRY N. STOKES (*J. Amer. Chem. Soc.*, 1900, 22, 625—630).—Mitscherlich's process, heating the ferruginous substances with a mixture of 3 parts of sulphuric acid and 1 part of water in a sealed tube from which the air has been expelled, gives utterly untrustworthy results in the analysis of ferruginous rocks when sulphides are also present. Owing to the high temperature, 160—200°, to which the tube is exposed, the sulphur is oxidised at the expense of any ferric oxide present and thus causes an apparent increase in the ferrous iron.

The hydrofluoric method is not affected by the presence of moderate quantities of sulphides.

L. DE K.

Estimation of Pyrrhotite in Pyrites Ore. By F. B. CARPENTER (*J. Amer. Chem. Soc.*, 1900, 22, 634—637).—Two grams of the sample, ground sufficiently finely to pass through a 100-mesh sieve, are boiled in a covered beaker with 30 c.c. of strong hydrochloric acid for

10 minutes; the insoluble portion is then collected on a weighed Gooch crucible, washed successively with warm dilute hydrochloric acid, hot water, and alcohol, and then repeatedly with small portions of carbon disulphide. After drying at 100° , the residue consisting of iron disulphide and silica is weighed and by deducting the amount of the latter, previously ascertained, the weight of the former is found. The sulphur present in the iron disulphide is subtracted from the total sulphur previously determined and the difference is calculated to pyrrhotite (Fe_7S_8). The presence of pyrrhotite may be ascertained by means of a magnet.

If zinc or copper sulphides are present in appreciable quantities an allowance must be made for the sulphur they contain. Zinc which is present as normal sulphide will be completely dissolved by the hydrochloric acid. Copper, however, may remain in the residue in the form of double copper iron sulphide (CuFeS_2) and its amount should be allowed for.

L. DE K.

Estimation of Cobalt in New Caledonian Ores. By THOMAS MOORE (*Chem. News*, 1900, 82, 66—67).—These ores consist mainly of hydrated oxides of manganese iron, aluminium, cobalt, and nickel, with relatively small proportions of calcium, magnesium, zinc, lithium, &c., and occasionally barium and copper. The cobalt only is determined, usually by electrolytic deposition or precipitation as ammonium cobalt phosphate. The ores contain from traces to 8 per cent.

In the author's method 2.5 grams of pulverised and dry ore are dissolved in hydrochloric acid, the solution evaporated to a syrup, and all soluble matter dissolved by adding water; 100 c.c. of a saturated solution of ammonium chloride are then added and the whole diluted to 400 c.c.; a solution of 1 part of strong ammonia in 15 of water is carefully but vigorously stirred in until the liquid becomes deep red, when 5 per cent. solution of sodium carbonate is dropped in until the liquid has only a slightly yellow tint. A further dilution to 500 c.c. follows, the whole being well shaken and filtered. Four hundred c.c. of the filtrate are heated to near the boiling point with 20 c.c. of saturated sodium acetate and 10 c.c. of acetic acid, and hydrogen sulphide is passed until nearly cold; the precipitate of cobalt, nickel, and zinc sulphides is filtered, washed with water containing hydrogen sulphide, dried, and ignited, then dissolved in hydrochloric acid with a little nitric acid, the latter being eliminated by twice evaporating with hydrochloric acid. The chlorides are dissolved in water, any iron removed by an emulsion of zinc oxide, the filtrate made up to 50 c.c., mixed with 10 to 15 c.c. of 10 per cent. hydrogen peroxide, then with 10 c.c. of 10 per cent. sodium or potassium hydroxide, boiled to remove excess of hydrogen peroxide, cooled, digested with potassium iodide and hydrochloric acid, and titrated with sodium thiosulphate (iodine $\times 0.46511$ = cobalt).

D. A. L.

Separation and Estimation of Small Quantities of Cobalt in the Presence of Nickel. By THOMAS MOORE (*Chem. News*, 1900, 82, 73).—The solution containing the chlorides of nickel and cobalt, after removal of any iron by means of zinc oxide and filtration, is diluted, heated nearly to boiling with a drop of hydrochloric acid,

then treated with bromine water and zinc oxide, boiled to expel most of the bromine, and filtered. The washed precipitate is stirred with a solution of hydrogen peroxide and sodium hydroxide, boiled to destroy excess of the peroxide, cooled, digested with potassium iodide and hydrochloric acid, and titrated with sodium thiosulphate, $I \times 0.46511 =$ Co.

D. A. L.

Qualitative Separation of Nickel from Cobalt by the Action of Ammonium Hydroxide on the Ferricyanides. By PHILIP E. BROWNING and JOHN B. HARTWELL (*Amer. J. Sci.*, 1900, [iv], 10, 316—317).—The difficulties in F. W. Clarke's method (*ibid.*, 1894, [iii], 48, 67) of separating nickel from cobalt by precipitating as ferricyanides and extracting the nickel with strong ammonia, are caused by the passage of cobalt ferricyanide through the filter and by the separation of sulphur in the subsequent precipitation of the nickel with ammonium sulphide. The method works well, however, if a few drops of a solution of alum are added before precipitating the ferricyanides, and if the nickel is subsequently precipitated with sodium or potassium hydroxide; in this way, less than a milligram of nickel can be clearly detected.

T. M. L.

Separation of Cobalt and Nickel by means of Persulphates. By F. MAWROU (*Zeit. anorg. Chem.*, 1900, 25, 196—200).—According to the author's previous work (this vol., ii, 596), the separation of cobalt and nickel by means of persulphates, as described in Salomon and Coehn's patent (*Zeit. Elektrochem.*, 1900, 6, 43, 532), is not quantitative. In the case of the mixed salts of the two metals, the precipitate of cobalt oxide contains a small quantity of nickel and a small quantity of cobalt remains in solution, whilst if the mixed hydroxides are employed, they are both only partially converted into higher oxides, and on the addition of acids to the black precipitate both cobalt and nickel are dissolved.

E. C. R.

Analysis of Chrome-Iron Ore by the Borax Method. By R. W. EMERSON MACIVOR (*Chem. News*, 1900, 82, 97).—To prepare chrome-iron ore for analysis, the author strongly recommends Dittmar's process, which he describes as follows: 4 grams of a mixture of 3 parts of sodium potassium carbonate and 2 parts of borax, are fused in a platinum crucible, allowed to solidify, 0.5 gram of the ore (which must be ground to an impalpable powder) placed on the top of the mass, the whole fused with the lid on, then the crucible placed at an angle on the triangle, heated, and the contents stirred with a platinum wire for half an hour, allowed to solidify, and then fused again with 2.5 grams of sodium potassium carbonate. The mass is heated with water on a water-bath, filtered, and the chromates washed out.

D. A. L.

Analysis of Chrome and Tungsten Steels. By ALEXANDER G. M'KENNA (*Chem. News*, 1900, 82, 67—68).—The steel is heated with hydrochloric acid, and the evolved gas absorbed in a solution of ammonium cadmium chloride for the estimation of sulphur. The hydrochloric acid solution is heated with nitric acid, twice evaporated to dryness with hydrochloric acid, dissolved in the same acid, diluted, and the residue of tungstic acid and silica dried, weighed, and treated with hydrofluoric acid to remove silicon. It is then weighed again, fused with sodium carbon-

ate, extracted with hot water, and any residue of iron oxide weighed. The hydrochloric acid solution is concentrated, boiled with some nitric acid to drive off hydrochloric acid, and then with large quantities of the same acid and potassium chlorate; the precipitate is dissolved in hydrochloric acid, the solution treated with ammonia and ammonium acetate, and the manganese precipitated with bromine. The chromium is determined in the nitric acid solution by diluting and titrating with ferrous sulphate and permanganate. The phosphorus and carbon may be estimated in the usual way in separate portions of the steel. D. A. L.

Estimation of Molybdenum in Steel and Steel-making Alloys. By FRED IBBOTSON and HARRY BREARLEY (*Chem. News*, 1900, 81, 269—271).—Steel, or ferromolybdenum, containing small proportions of molybdenum is dissolved in hydrochloric acid, in quantities of about 2 grams, and oxidised with nitric acid or potassium chlorate, the solution neutralised, or nearly so, with sodium carbonate, avoiding the formation of a red coloration or precipitate, and passed through a small pulp filter, which is then placed in a flask containing 2*N* sodium hydroxide to the extent of 30—40 c.c. in excess of that required to precipitate all the iron. When the filter is disintegrated, the contents of the flask are heated nearly to boiling, well agitated, fractionally filtered, acidified with hydrochloric acid, and the molybdenum precipitated as lead molybdate in the manner previously described (*Abstr.*, 1899, ii, 129).

The presence of molybdenum in steel does not affect the estimation of silicon, or of manganese when no large excess of ammonium acetate is used to precipitate the iron, or when six instead of three separate lots of chlorate are added in the volumetric method by oxidation with potassium chlorate in nitric acid solution; or of sulphur if the barium chloride is added to a distinctly acid solution; or of phosphorus if the long (acetate) method is followed, or in the rapid method when dissolving in ammonia and precipitating with magnesia mixture is adopted. Carbon in the residue obtained by treating the sample with copper solutions retains some molybdic oxide. In the presence of molybdenum, iron cannot be estimated gravimetrically, or by simple solution and titration, but reduction with sulphurous acid and titration with potassium dichromate or permanganate is effective. Nickel-molybdenum containing but little iron is dissolved in aqua regia, the solution poured into excess of ammonia, and the molybdenum precipitated from a portion of the filtrate, whilst the nickel is determined in another portion cyanometrically. If more than a few tenths per cent. of iron is present, a second precipitation is necessary, and the filtrates are mixed before determining the nickel and the molybdenum; with much iron, the molybdenum must be separated by means of sodium hydroxide as in the case of steels, and the nickel and iron separated afterwards in a fresh sample by means of ammonia.

Molybdenum powders have been found to contain metallic molybdenum and its oxide, tungsten and its oxides, silica, alumina, iron, ferric oxides, combined and free carbon, sulphur, and water. The total carbon and combined carbon may be determined in the usual manner, the molybdenum by heating carefully with sodium carbonate and potassium nitrate under sodium carbonate in a platinum crucible, over

a blowpipe, avoiding volatilisation of molybdenum as oxide, extracting with water, and precipitating with lead acetate, &c., as previously set forth (this vol., ii, 445). Methods are also suggested for determining the quantity of oxides present in the powder. D. A. L.

[Estimation of small quantities of Platinum in Gold.] By HEINRICH RÖSSLER (*Chem. Zeit.*, 1900, 24, 733—735).—See this vol., ii, 733.

Volumetric Estimation of Iodoform in Dressings. By MARTIN LEHMANN (*Chem. Centr.*, 1900, ii, 397; from *Pharm. Zeit.*, 45, 522—523).—The author has slightly modified his process (this vol., ii, 372.) Ten grams of the material are treated in a glass stoppered bottle with 200 c.c. of "Spiritus æthereus" for 24 hours at 20—25° with constant agitation; 20 c.c. of the solution are then treated as previously directed. L. DE K.

Testing Lemonade Essences. I. Essence of Lemon and of Bitter Orange. By NEUMAN WENDER and GEORG GREGOR (*Zeit. Nahr. Genussm.*, 1900, 3, 449—459).—The article is chiefly a review of the various methods in use for estimating the amount of alcohol and ethereal oils.

Alcohol may be estimated by Schade's salt process, but the authors prefer the method proposed by Hefelmann (*Abstr.*, 1897, ii, 605). In many cases, the simple determination of the sp. gr. of the sample answers the purpose. Ethereal oil is best estimated by a process communicated by Mann which consists in observing the diminution in volume, when the sample is diluted largely with water containing a little sulphuric acid, and then shaken with light petroleum.

The solubility of the essences in water is determined by the authors as follows. One c.c. of the sample is put into a tall graduated cylinder and water at 17.5° is gradually added with constant shaking until a perfectly clear solution is obtained.

Admixture of oil of lemon or bitter orange or of citral may be detected by the lessened solubility in water, and the polarisation of the petroleum extract. Vanillin may be isolated by evaporating off the alcohol, adding lead acetate, and shaking the filtrate with ether. The vanillin is then removed by shaking with dilute ammonia, the liquid is acidified with hydrochloric acid, and the vanillin again extracted with ether; finally, the phloroglucinol test is applied. L. DE K.

Separation of Oleic Acid from other Unsaturated Acids. By K. FARNSTEINER (*Zeit. Nahr. Genussm.*, 1900, ii, 3, 537—539. Compare *Abstr.*, 1899, ii, 705).—A reply to Lewkowitsch (this vol., ii, 376). L. DE K.

Estimation of Lactic Acid in the Commercial Article. By FERDINAND JEAN (*Chem. Centr.*, 1900, ii, 692; from *Ann. Chim. anal. appl.*, 5, 285).—Commercial lactic acid contains mineral acids, oxalic acid, volatile organic acids, and various salts. A known quantity is freed from volatile acids by repeatedly evaporating with water, then boiled with barium carbonate, and the filtered solution

evaporated and gently ignited. The barium carbonate in the ash is thoroughly washed, dissolved in a known excess of standard hydrochloric acid, and the excess titrated back 1 c.c. of *N*/10 acid = 0.009 gram of lactic acid. M. J. S.

Detection and Estimation of Acetoacetic Acid in Pathological Urine. By V. ARNOLD (*Chem. Centr.*, 1900, 345—346; from *Centr. inn. Med.*, 21, 417—423).—The characteristic test for acetoacetic acid with diazoacetophenone described by the author (this vol., ii, 113) is best applied to urine previously decolorised with animal charcoal. All samples which give Legal's acetone reaction also give a positive diazoacetophenone test. Ehrlich's *p*-diazobenzenesulphonic acid cannot be used instead. Salts of acetoacetic acid differ from ethyl acetoacetate in their behaviour with the latter reagent; they cause a light yellow colour, which turns deep red or dark purple on adding ammonia, whilst the ester gives an orange-red colour changed to pure red by ammonia. On the other hand, when using the author's reagent, the ammoniacal solution of salts of acetoacetic acid is brownish-red with a similarly coloured precipitate, and that of ethyl acetoacetate vermilion-red with a similarly coloured, finely granular precipitate. The precipitates are soluble in strong hydrochloric acid, with a purple-violet colour. If the freshly prepared solution of diazoacetophenone is so much diluted that addition of ammonia does not cause a yellow coloration and a salt of acetoacetic acid is then added, a passing yellow coloration is observed gradually turning into a dark purple violet, which, after a few minutes, fades and turns yellow again; ethyl acetoacetate gives at once a reddish-yellow coloration.

According to the author, acetone does not pre-exist in urine; the reaction obtained is due to acetoacetic acid. L. DE K.

Estimation of Potassium Hydrogen Tartrate in Wine. By LOUIS MAGNIER DE LA SOURCE (*Chem. Centr.*, 1900, ii, 692; from *Ann. Chim. anal. appl.*, 5, 281).—In attempting to estimate the potassium hydrogen tartrate by Berthelot and Fleurieu's method (precipitation by a mixture of alcohol and ether), complete precipitation is not obtained unless there is an excess either of tartaric acid or of a potassium salt. The author recommends that the latter should be added in the form of potassium bromide, of which a large excess is not injurious. M. J. S.

Estimation of Malic Acid. By ALBERT HILGER (*Chem. Centr.*, 1900, ii, 597—598; from *Verh. Vers. Deut. Naturf. und Aerzte*, 1899, 668).—Malic acid precipitates metallic palladium (0.294 gram of metal per gram of acid) from neutral or feebly alkaline solutions of palladium chloride. Glycerol and glycollic acid have the same effect, but tartaric, citric, succinic, and oxalic acids have no action. To estimate malic acid in wine, the alcohol and volatile acids are distilled off, colouring matters and tannic acid removed by charcoal, and the fruit acids then precipitated by basic lead acetate. The precipitate is dissolved in acetic acid, and the lead removed by a small excess of sodium carbonate; a 2 per cent. solution of palladium chloride is added, and then sodium carbonate to exact neutrality; the palladium separates

on shaking. The mixture is feebly acidified, heated for $1\frac{1}{2}$ hours on the water-bath, and the metal collected and dried. Tartaric acid reduces platinic chloride, malic acid does not.

M. J. S.

Uric Acid and Purine Bases in the Blood and Animal Organs. By WILHELM HIS, jun., and W. HAGEN (*Zeit. physiol. Chem.*, 1900, 30, 350—383).—The estimation in the blood and extracts of organs of uric acid and the various purine bases is difficult on account of the proteid present. The precipitation of guanine with ammoniacal silver solutions is hindered by small quantities of albumose; if large quantities are present, they are partially precipitated with it. Removal of the albumoses by ammonium sulphate or by trichloroacetic acid does not interfere with the subsequent precipitation of the bases by ammoniacal silver solution; zinc sulphate, however, does; but even with the ammonium sulphate method, there is considerable loss of the bases. Besides albumoses, other substances, such as nucleic acid, interfere with the results; in fact, in extracts of organs much worse results are obtained than in artificial mixtures. The lead acetate method, also, is untrustworthy. Much the same is true for uric acid, and the best results were obtained by employing Stad-hagen's method of extracting the organs with 0.5 per cent. sulphuric acid.

W. D. H.

Detection of Salicylic Acid in Presence of Citric Acid. By A. CONRADY and by OTTO LANGKOPF (*Chem. Centr.*, 1900, ii, 596; from *Apoth. Zeit.*, 15, 412, 462; *Pharm. Centr.*, 41, 411, 464).—Langkopf (this vol., ii, 695) has stated that citric acid prevents the reaction between ferric chloride and salicylic acid, and recommends a preliminary extraction of the latter with a mixture of ether and light petroleum. CONRADY considers that the failure to produce a violet colour is due to reduction of the ferric salt, since it can be developed by adding an oxidising agent (nitric acid or hydrogen peroxide).

LANGKOPF replies to Conrady that ferric chloride is not reduced by citric or tartaric acid, and denies that the violet colour is developed by adding nitric acid or hydrogen peroxide.

CONRADY, in rejoinder to Langkopf, states that he worked with a 1 per cent. solution of salicylic acid, Langkopf having employed one of only 0.1 per cent., and admits that below 1 per cent. the addition of an oxidising agent is ineffectual.

LANGKOPF states that the explanation of Conrady's results is, that on mixing ferric chloride with citric acid, ferric citrate is produced which has no action on salicylic acid. The addition of any strong acid prevents the formation of ferric citrate. Conrady's hydrogen peroxide probably contained free sulphuric acid.

M. J. S.

Detection of Salicylic Acid in the Presence of Citric Acid. By J. E. GEROCK (*Chem. Centr.*, 1900, ii, 597; from *Pharm. Centr.*, 41, 464).—With reference to the controversy between Langkopf and Conrady, it is to be observed that all soluble acids are capable of preventing the ferric reaction of salicylic acid if present in sufficient excess. The violet coloured substance is to be regarded as salicylic acid in which the hydrogen of a hydroxyl group is replaced

by triatomic iron, and it is not formed if another acid, even citric, is present, for which iron has a greater affinity. M. J. S.

Detection of Salicylic Acid in Presence of Citric Acid. By A. KLETT (*Chem. Centr.*, 1900, ii, 545; from *Pharm. Centr.*, 41, 452).—Jorissen's method for detecting salicylic acid in beer serves equally well for lemon juice. Ten c.c. of the juice are mixed with 4 drops of a 10 per cent. solution of sodium nitrite, 4 drops of acetic acid, and 1 drop of a 10 per cent. copper sulphate solution, and heated to boiling. Salicylic acid produces a blood red coloration, which is best observed just as the liquid begins to boil. M. J. S.

Detection of Salicylic Acid in Milk. By P. STÖSS (*Chem. Centr.*, 1900, ii, 545; from *Pharm. Centr.*, 41, 437).—The presence of 0.2 per cent. of citric acid does not prevent the detection of 0.005 gram of salicylic acid in 100 c.c. of milk.

One hundred c.c. of milk are coagulated by warming at 80° with 1.5 c.c. of a 20 per cent. solution of calcium chloride, and the filtrate allowed to drop through 50 c.c. of ether, which is then evaporated in a porcelain basin and tested by running in from the edge 1—2 drops of dilute ferric chloride-solution diluted with 10 c.c. of water.

M. J. S.

Estimation of Hippuric Acid. By FERDINAND BLUMENTHAL (*Chem. Centr.*, 1900, ii, 447; from *Zeit. klin. Med.*, 40, 3—4).—Three hundred c.c. of human urine are rendered alkaline with sodium carbonate and evaporated to dryness. The residue is extracted twice with 150 c.c. of 96 per cent. alcohol on a warm water-bath, and the alcoholic filtrate evaporated to a syrup. This is dissolved in 50 c.c. of water, acidified with 10 c.c. of 20—25 per cent. hydrochloric or sulphuric acid, and shaken with 200 c.c. of ether containing 20 c.c. of alcohol; the ethereal layer is then shaken with 75 c.c. of water and finally distilled. The extraction is repeated four times, and the ether residues are then dissolved in 20 c.c. of water and introduced into a Kjeldahl flask. (If much colouring matter is present, it is removed by shaking the solution in a separating funnel with 15 c.c. of chloroform.) The nitrogen is then estimated in the usual manner, and from its amount the hippuric acid is calculated.

The process is attended with a loss of about 15 per cent. of the hippuric acid present, but suffices for the comparative clinical examination of urine.

L. DE K.

A Multiple Fat Extractor. By CHARLES L. PENNY (*Amer. Chem. J.*, 1900, 24, 242—249).—The apparatus is a modification of the Soxhlet extractor. Its essential part is a chamber made of a nearly horizontal brass cylinder 2 inches and a half in diameter and 30 inches long, wherein may be placed a semicircular rack holding 51 shallow capsules containing the samples to be extracted. The cylinder has a capacity of about 2400 c.c. The other parts of the apparatus are a vessel in which the extracting liquid is boiled by means of steam passing through lead coils, block tin condensers, and the usual syphoning arrangement.

The milk is dried in the capsule with addition of coarse sand or

asbestos; after being weighed, the capsule is placed in the extractor, ether, or better, light petroleum boiling below 100° , being used as the extracting liquid. The capsule is then dried and reweighed, the loss representing the fat. Cream or butter must be absorbed in asbestos or glass wool.

L. DE K.

Variation in Milk Solids; Control of Milk Supply. By A. REINSCH and H. LÜHRIG (*Zeit. Nahr. Genussm.*, 1900, 3, 521—524).—The authors communicate fifty experiments from which it again appears that milk, even before it actually turns sour, may apparently have lost as much as 0.6 per cent. of solids owing to decomposition. This does not, however, affect the sp. gr. of the milk, so that as a rule more trustworthy results are obtained by calculating the total solids from the sp. gr. and the fat than by a direct estimation. From this it also follows that it is very risky to calculate the fat from the sp. gr. and the solids actually determined.

When dealing with sour milks not more than 3 days old, the sp. gr. of the serum should be taken as affording the only safe evidence as to the addition of water. It is also incidentally remarked that total solids cannot be accurately estimated in sour milk liquefied with ammonia.

L. DE K.

Estimation of Fat in Condensed Milk. By ALBERT E. LEACH (*J. Amer. Chem. Soc.*, 1900, 22, 589—591).—Forty grams of the well-mixed sample are diluted with water and made up to 100 c.c. and 25 c.c. of this solution introduced into an ordinary Babcock test-bottle. After nearly filling with water, 4 c.c. of a 7 per cent. solution of copper sulphate are added and the whole is whirled, preferably without heating, to make the precipitate settle. The supernatant liquid is then drawn off with a pipette, over the bottom of which a small wisp of absorbent cotton is first twisted to serve as a filter; this is afterwards wiped off into the bottle by rubbing against its inner side.

The precipitate which contains all the fat is washed twice to remove all cane sugar, water is then added to represent the usual volume of milk used in the experiment, and the usual Babcock sulphuric acid process applied. The result of the reading multiplied by 1.8 equals the percentage of fat.

L. DE K.

Estimation of Fat in Sweetened Condensed Milk. By JOSEPH F. GEISLER (*J. Amer. Chem. Soc.*, 1900, 22, 637—645).—Fat in condensed milk may be estimated with reasonable accuracy by the Adams' or coil process, provided not more than 1 gram of the sample is operated on, and that the extraction is continued for about 5 hours.

Light petroleum of low boiling point, or a mixture of 15 per cent. of this with dry ether, is recommended as the extracting liquid.

L. DE K.

Estimation of Fat in Sweetened Condensed Milk by the Babcock Test. By E. H. FARRINGTON (*Amer. Chem. J.*, 1900, 24, 267—270).—When estimating fat in condensed milk by the centrifugal methods, it is advisable to first remove the added sugar as this

causes a very unsatisfactory reading of the fatty layer (compare preceding abstracts). 40—60 grams of the sample are weighed into a 200 c.c. flask, about 100 c.c. of water are added to dissolve the milk, and after diluting to the mark and shaking, 17.6 c.c. are measured into a Babcock test-bottle. Three c.c. of sulphuric acid are added and the bottle is whirled for 6 minutes in a steam-heated turbine centrifuge at a speed of 1000 revolutions.

The whey is now poured off, 10 c.c. of water and 3 c.c. of acid are added, the curd is well shaken and the bottle whirled a second time; this treatment practically removes all the sugar and after pouring off the washings, the residual curd and fat are treated with 10 c.c. of water and 17.5 c.c. of sulphuric acid and the operation conducted as in the case of an ordinary milk. L. DE K.

Estimation of the Volatile Acids in Butter by Leffmann-Beam's Glycerol-Soda Process. By ANTON SKYDA (*Chem. Zeit.*, 1900, 24, 752—753).—The amount of sulphuric acid stated to be sufficient to decompose the soap when butter is saponified with Leffmann-Beam's solution of sodium hydroxide in glycerol has been found by the author to be often insufficient. The amount should be doubled and a correspondingly smaller quantity of water used to dissolve the soap. In the case of doubtful results, it is advisable to check the work by the ordinary Reichert-Meissl process. L. DE K.

Chemical Action of Mould on Butter. By JOS. HANUŠ and ALB. STOKČÍ (*Zeit. Nahr. Genussm.*, 1900, 3, 606—614).—A series of experiments with nine different kinds of fungus on butter for various lengths of time.

In the first experiment the butter was inoculated with the fungi and exposed in thin layers to moist air in the dark. After three months the various portions and also the non-inoculated original were analysed in the usual way. From the figures recorded it appears that the effect of the different fungi is practically the same; the only figure seriously affected is the acidity number, which was raised some 24 degrees.

In another experiment which lasted one year, the sample was inoculated with *Mucor mucedo* and the only figures notably affected were the saponification and ether numbers and the molecular weight of the free volatile acids. Further experiments have shown that the fungi at first thrive on the casein and lactose and then live at the expense of the glycerol; they also cause the oxidation of the lower volatile acids contained in the liberated fatty acids. L. DE K.

The Halphen Colour Test and its Value for the Detection of Cotton Seed Oil. By ROZIER D. OILAR (*Amer. Chem. J.*, 1900, 24, 355—373).—To dispense with the use of amyl alcohol and a bath of boiling aqueous sodium chloride in the Halphen test (Abstr., 1898, ii, 358) is a disadvantage rather than an advantage as claimed by Soltsien (Abstr., 1899, ii, 323); ethyl alcohol gives a less pronounced coloration than amyl alcohol. The examination of a large number of the common oils and fats shows that the test is given by cotton seed oil alone, and the value of the reaction is enhanced by the fact that none

of the ordinary colouring matters or adulterants responds to it. The test is capable of indicating rather less than 0.1 per cent. of cotton-seed oil in fresh, colourless lards, and is very pronounced with 1 per cent. of the oil. The test can be used more or less quantitatively by comparing the depths of colour produced with those obtained with equally concentrated volumes of known mixtures of lard and cotton seed oil; the results are most satisfactory with lards containing less than 1 per cent. of the oil (compare Strzyzowski, this vol., ii, 325).

W. A. D.

Maripa Fat. By W. P. H. VAN DEN DRIESSEN MAREEUW (*Chem. Centr.*, 1900, ii, 637—638; from *Ned. Tijds. Pharm.*, 12, 245—249).—Maripa fat, obtained by boiling or pressing the fruit of *Palma maripa*, is colourless or faintly yellow, has a slight taste and pleasant odour, and is used in the West Indies instead of butter. It has a sp. gr. 0.8686 at 100°, melts at 26.5—27°, solidifies at 24—25°, and has an acid number 31.095, saponification number 270.5, ether number 239.40, Hehner number 88.88, Reichert-Meissl number 4.45, and Hübl's iodine number 17.35. The fatty acids melt at 27.5—28.5°, solidify at 25°, and have a sp. gr. 0.823, and Hübl's iodine number 12.15.

E. W. W.

Simple Analysis of Wool Fat. By HUGO BORNTÄGER (*Zeit. anal. Chem.*, 1900, 39, 505).—Wool fat consists mainly of oleic, stearic, margaric, and palmitic acids, with small amounts of water and insoluble impurities. A gram of the fat is dried at 110° to estimate water, then dissolved in 50 c.c. of hot absolute alcohol, and the insoluble matter collected on a weighed filter. The alcoholic filtrate and washings are concentrated to 50 c.c. and left at rest for 24 hours in the cold. The solid fatty acids crystallise out and are weighed, after washing three times with cold alcohol and drying at 105°. The remainder is regarded as oleic acid.

M. J. S.

Estimation of Aldehydes by Means of Hydrazines. I. **Estimation of Vanillin.** By JOS. HANUŠ (*Zeit. Nahr. Genussm.*, 1900, 3, 531—537).—The aqueous solution of vanillin is mixed with a hot solution of *p*-bromophenylhydrazine in such proportion that 2—3 parts of the hydrazine will be present for 1 part of vanillin. After 4—5 hours, the crystalline precipitate is collected in a weighed Gooch crucible containing asbestos, washed with hot water, dried at 100° and weighed. One part of vanillin yields 2.105 parts of the hydrazine compound.

Experiments with other aldehydes are in progress.

L. DE K.

Detection of Aldehyde in Vinegar prepared by Fermentation. By CARL BÖTTINGER (*Chem. Zeit.*, 1900, 24, 793—794).—Vinegars prepared by fermenting alcoholic liquors always contain traces of aldehyde, whereas diluted acetic acid made to resemble vinegar is devoid of that substance.

The aldehyde may be tested for in the usual manner by pouring some of the vinegar on to a solution of a few milligrams of resorcinol in 4 c.c. of sulphuric acid contained in a test-tube, and noticing the characteristic ring at the place of contact. It is remarkable that

when dealing with a true fermentation vinegar, the reaction may also be obtained, although in a lesser degree, with the residue left on evaporation ; this, of course, cannot contain any free aldehyde, but may contain a non-volatile compound of it. L. DE K.

New Colour Reaction for Citral and certain other Aromatic Compounds. By HERBERT E. BURGESS (*Analyst*, 1900, 25, 265—266).—Ten grams of mercuric sulphate are dissolved in, and made up to 100 c.c. with, 25 per cent sulphuric acid. Two c.c. of the substance to be tested are put into a small phial fitted with a cork, 5 c.c. of the reagent are added, the whole is vigorously shaken and the colour noticed at once, and also after 10 minutes. The following reactions are characteristic : Cinnamaldehyde, formaldehyde, acetaldehyde, benzaldehyde, and anisaldehyde give no reaction. Citral gives a transient, bright red coloration, and a whitish compound floating on the surface ; citronellal a fairly permanent yellow coloration ; limonene faint flesh coloration which instantly disappears ; linalyl acetate a permanent brilliant violet coloration ; linalool a deep violet coloration ; caryophyllin a yellowish coloration ; eugenol a slight violet coloration after a time, and terpineol a flesh coloration and precipitate.

Oil of cassia gives a yellowish compound floating on the surface and no reduction on shaking. Oil of cinnamon forms a brown compound and a slight violet-coloured aqueous layer ; after a time the whole becomes a solid black mass. Oil of cloves gives a violet aqueous layer which becomes darker when kept. L. DE K.

Chemicotoxicology of Sulphonal and Analogous Compounds. By DIOSCORIDE VITALI (*Chem. Centr.*, 1900, ii, 646—647 ; from *Boll. Chim. Farm.*, 39, 461, 497).—To isolate sulphonal from an organic liquid, the liquid is evaporated to dryness, extracted with hot 90 per cent. alcohol, the alcoholic extract filtered after cooling, and distilled. The residual aqueous liquid is filtered while hot, made feebly alkaline with potassium hydroxide, and shaken with ether. The ethereal solution when evaporated leaves a colourless residue of sulphonal, easily recognised under the microscope by the characteristic dendritic form of its crystals. The reactions proposed by Schwartz, Vulpius and others depending on fusion with alkali are not characteristic as they are produced by other sulphur compounds.

Sulphonal may, however, be detected by the following reactions. The substance is heated with three parts of powdered potassium hydroxide, when the liquid becomes yellow, then red, and the colour changes to blue on adding water. On acidifying with hydrochloric acid, an ephemeral violet colour is produced and sulphur separates, whilst sulphur dioxide is evolved, and a sulphate can be detected in the solution. The thiosulphate formed can also be recognised by adding potassium nitrite and an acid, when a transient, yellow colour is produced by the solution of nitric oxide in thiosulphuric acid. That a polysulphide is also formed can be shown by adding sodium nitroprusside.

The homologues of sulphonal (trional and tetronal—see Abstr., 1889, 1233) can be distinguished from sulphonal by their crystalline form and lower melting points. Sulphonal is not altered by the pre-

sence of putrefying matter. All three sulphones pass, to some extent, unchanged into the urine.
M. J. S.

Analysis of Gutta Percha. By HUGO BOENTRÄGER (*Zeit. anal. Chem.*, 1900, 39, 502—504).—Of the three substances, gutta, fluavil, and alban, of which gutta percha is composed, the last is not a chemical individual, but consists approximately of 30 per cent. of a pale resin oil boiling at 200°, 30 per cent. of a dark yellow oil boiling at 250° and 40 per cent. of a solid resin resembling colophony. For the analysis of the crude material, moisture is estimated by drying in an air current at 100°, and woody fibre and earth by dissolving 1 gram in hot benzene. The benzene solution is then concentrated to 50 c.c., mixed with 100 c.c. of absolute alcohol, and kept at 100° for 2 hours. The gutta precipitates, and is weighed after washing with hot alcohol. The alcoholic solution is concentrated to 50 c.c. and cooled in a weighed basin. The fluavil separates and is weighed after washing with cold alcohol and drying at 80°, but as it is more volatile than alban it is better to estimate it from the difference after evaporating the solution containing the alban and drying the latter at 80°
M. J. S.

Estimation of Glycyrrhizin in Liquorice Extract. By B. HAFNER (*Chem. Centr.*, 1900, ii, 501; from *Zeit. Oesterr. Apoth. Verein.*, 38, 241—244. Compare this vol., ii, 328).—The author has shown that the well-known insolubility of glycyrrhizin in dilute sulphuric acid is not due to a chemical combination. Pure glycyrrhizin can only be obtained by extraction with alcoholic sulphuric acid, coupled with purification by acetone as described in the first paper. More glycyrrhizin may apparently be extracted by means of ammoniacal water, but in that way an impure product is obtained. All samples do not yield an equally pure product.
L. DE K.

Analysis of Cayenne Pepper. By GEORG GREGOR (*Zeit. Nahr. Genussm.*, 1900, 3, 460—471).—The author has proved that the plant (*Capsicum annuum*) does not assimilate barium or lead salts when either of these has been purposely added to the soil. Should salts of these metals be found in the commercial article, it may be safely assumed that they have been wilfully added.

It is also stated that the only way of ascertaining the genuineness of cayenne pepper (the ground fruit) is by a thorough microscopic examination. A somewhat high ash does not necessarily point to adulteration; should it, however, amount to 10 per cent., it is as well to treat it with hydrochloric acid and test both the soluble and insoluble portions.
L. DE K.

Estimation of Santonin. By KARL THAETER (*Arch. Pharm.*, 1900, 233, 383—387. Compare *Abstr.*, 1898, ii, 59; 1899, ii, 619; this vol., ii, 122, 583).—The loss in the author's process is not more than about 10 per cent. As a further improvement in the method the recommendation is made that, after the boiling with milk of lime, the alkaline liquid should be slightly acidified with sulphuric acid, and warmed until crystals of santonin begin to separate, before the solution of aluminium acetate is added.
C. F. B.

Detection of Coal-Tar Dyes in Fruit Products. By A. L. WINTON (*J. Amer. Chem. Soc.*, 1900, 22, 582—588).—The author communicates his experiences with some of the recognised methods for the detection of coal-tar colours in foods.

Arata's "wool process" is satisfactory; it is, however, preferable to apply the confirmatory tests to the wool itself and not to the colouring matter obtained from it, because some coal-tar dyes are not properly extracted by amyl alcohol from an alkaline solution. It is also pointed out that some natural colouring matters such as chlorophyll merely form a coating on the wool which may be easily rubbed off, whilst coal-tar colours act as true dyes.

Girard and Dupre's processes (removal of the dye with amyl alcohol either from an alkaline or acid solution and treating the alcoholic extract with wool) give good results. Girard's process for acid magenta (treatment with potassium hydroxide and mercuric acetate and then acidifying the filtrate with sulphuric acid) is useful in the examination of fruit juices and syrups but unsatisfactory in the case of jellies. Cazeneuve's mercuric oxide method, although to be recommended for wines, is not satisfactory for the examination of jellies but may, perhaps, answer for fruit juices and syrups. L. DE K.

Detection of Indican in Pathological Urine. By A. KLETT (*Chem. Zeit.*, 1900, 24, 690).—Ammonium persulphate is much better than bleaching powder as a reagent for indican in urine. A crystal of ammonium persulphate is added to a mixture of urine (10 c.c.) and 25 per cent. hydrochloric acid (5 c.c.), and the mixture shaken with chloroform; the imparting of a blue colour to the latter proves the presence of indican. J. J. S.

Ehrlich's Diazo-reaction. By G. WESENBERG (*Chem. Centr.*, 1900, ii, 67—68; from *Apoth. Zeit.*, 15, 326—328).—The reagent is generally prepared as follows. One gram of sulphanilic acid is dissolved in water containing 50 c.c. of hydrochloric acid and diluted to a litre. When required, 10 c.c. of the solution are mixed with 2 c.c. of a 0.5 per cent. solution of sodium nitrite, and 10 c.c. of the mixture followed by 2.5 c.c. of ammonia are then added to 10 c.c. of the urine to be tested, and the whole is vigorously shaken. If a reaction is obtained and the red liquid exposed to the air for 24 hours, a greenish deposit is obtained, but it often fails to form in cases of tuberculosis.

The author advises that no alterations should be made in the application of the test. It is stated that the diazo-reaction may be caused when naphthalene has been administered; bilirubrin also gives the test, and should be removed by a preliminary treatment with lead acetate or animal charcoal. On the other hand, preparations of tannic acid seem to prevent the reaction. L. DE K.

Ehrlich's Diazo-reaction for the Recognition of some recently introduced Morphine Derivatives. By LUIGI CARCANO (*Chem. Centr.*, 1900, ii, 288; from *Boll. Chim. Farm.*, 39, 425—428).—Ehrlich's reagent in the presence of ammonia (see preceding abstract) acts on heroine (diacetylmorphine), forming a red, crystalline azo-compound of the formula $\text{NH}_4 \cdot \text{SO}_3 \cdot \text{C}_6\text{H}_4 \cdot \text{N}_2 \cdot \text{C}_{21}\text{H}_{22}\text{O}_6\text{N}$. Morphine

gives a similar wine-red but less intense coloration. The reagent is particularly useful for the detection of small quantities of dionine (morphine ethyl ether) in codeine (morphine methyl ether). 0.01 gram of the suspected substance is dissolved in 1 c.c. of water, a few drops of ammonia are added, and then Ehrlich's reagent drop by drop. Pure codeine gives a fine yellow, but dionine a red colour. Narcotine, narceine, papaverine, and thebaine give either a faint yellow colour or no reaction at all.

L. DE K.

Assay of Opium. By J. B. NAGELVOORT (*Pharm. Weekblad*, 1900, No. 24, 1—8).—The acidimetric process introduced by Prescott and Gordin (Abstr., 1899, ii, 714) is recommended. No morphine is removed from the sodium chloride mixture by treatment with benzene, which merely dissolves the inferior opium alkaloids. The results are generally higher than those obtained by the gravimetric process of the U.S.P., but the difference is not always as high as 3 per cent.

A drawback to the method is the long time it takes, also the great waste of alcohol and chloroform, but these might be recovered by distillation.

L. DE K.

Modified Alkalimetric Method for the Valuation of Opium, and other Pharmaceutical Drugs and Preparations that contain Alkaloids. By HARRY M. GORDIN (*Arch. Pharm.*, 1900, 238, 335—341).—The method already described (compare Abstr., 1899, ii, 714, but especially this vol., ii, 110) has been modified slightly. *N*/40 sulphuric acid and *N*/40 potassium hydroxide are used, in place of *N*/20 solutions, in the titration of the alkaloid, which may be extracted in any suitable manner. If it has to be extracted from a solution alkaline with potassium hydroxide, say by shaking with a mixture of ether and chloroform, the extract will contain a little alkali, and must be freed from this before it is evaporated, best by shaking with a little ignited magnesia and filtering. In the case of alkaloids which dissolve with difficulty in very dilute acids, such as strychnine and hydrastine, it is better not to evaporate the ethereal solution, but to shake it with the excess of acid, and then distil off the ether cautiously before titrating.

The method was applied to opium (1 c.c. *N*/40 acid per gram of the sample = 0.71 per cent. of morphine), nux vomica (1 c.c. *N*/40 acid = 0.0091 gram alkaloid, reckoned as equal parts of strychnine and brucine), and cinchona bark (1 c.c. *N*/40 acid = 0.0077 gram alkaloid reckoned as equal parts of quinine and cinchonidine), and also to the commercial extracts of the last two substances and of *Hydrastis canadensis*.

C. F. B.

Action of Iodine on Aconitine and Caffeine. By CARL KIPPENBERGER (*Zeit. anal. Chem.*, 1900, 39, 435—450).—The author has endeavoured to extend to aconitine and caffeine the methods of titration based on the formation of alkaloid periodides (Abstr., 1886, 282, 682; 1899, ii, 534, 584). With caffeine, the presence of a considerable amount of free mineral acid is essential to the precipitation of the periodide; a portion of the caffeine always escapes precipitation, but this may be reduced to inconsiderable traces by using a large excess

of the iodine solution. The amount of iodine consumed varies with the conditions of the titration ; it generally approximates to 4 atoms for one molecule of caffeine, except in the case where the alkaloid hydrochloride is converted into hydriodide by a solution of silver iodide in potassium iodide (Abstr., 1896, ii, 682), when it is very close to 2 atoms. The iodine solution must therefore be standardised against weighed caffeine under conditions identical with those of the titration. Aconitine can be better estimated by alkalimetric titration (this vol., ii, 637) than by means of iodine. M. J. S.

Estimation of Nicotine, Amount of Nicotine in New South Wales Tobaccos. By G. HARKER (*Chem. News*, 1900, 81, 273).—Kissling's and Biel's methods give similar results ; but the modification of the latter involving the weighing of the double sulphates of nicotine and ammonia, and also attempts to estimate nicotine volumetrically in presence of ammonia, have not proved successful. No loss of nicotine has being observed during the evaporation of its ethereal solution. Four varieties of New South Wales tobaccos gave the following percentages of nicotine :—Manilla, 1.95 ; Tamworth, 2.36 ; Tumut, 3.84 ; Bathurst, 4.53. D. A. L.

Estimation of Strychnine. By E. H. FARR and ROBERT WRIGHT (*Pharm. J.*, 1900, [iv], 11, 82—85).—In view of Schweissinger's criticisms (*Pharm. J.*, 1885, [iii], 16, 447), the authors have examined the pharmacopoeial process for the assay of nux vomica preparations (compare Dunstan and Short, Abstr., 1883, 689, 1175). Strychnine ferrocyanide is not quite insoluble in water acidified with sulphuric acid, and if precipitated in presence of brucine, the latter can never be entirely separated. If the amount of brucine is large, this alkaloid may form more than half the precipitate ; almost the whole, however, can be removed by washing with acidified water. The authors recommend that not more than 5 c.c. of the liquid extract or 30 c.c. of the tincture should be assayed, and that 200 c.c. of wash water at a stated temperature (38°) should be employed, a correction being made for the strychnine dissolved by it. R. L. J.

Behaviour of Proteids to Alkaloid Reagents, and a Method of Estimating Combined Hydrochloric Acid. By OTTO COHNHEIM and H. KRIEGER (*Zeit. Biol.*, 1900, 40, 95—116).—The combinations of albumoses and hydrochloric acid which are formed in the stomach are salts which react acid to litmus, phenolphthalein, and other indicators, and neutral to Congo-red, methyl-violet, &c. If a mixture contains only hydrochloric acid and such acid proteoses, the use of such indicators enables the free acid to be estimated ; but this is not the case with the contents of the stomach, where salts and other acids are also present. For the estimation of acid-proteoses, salting-out is a method which was found impracticable, but certain alkaloid reagents precipitate them readily. Sodium phosphotungstate, for instance, will not precipitate proteid, but it will precipitate proteid which is combined with hydrochloric acid. In this, proteids resemble Hantzsch's pseudo-ammonium bases. Various alkaloid reagents were tested with artificial mixtures and stomach contents. The results

with calcium phosphotungstate and potassio-mercuric iodide were satisfactory, and agree well with those obtained by Sjoqvist's more complicated method. W. D. H.

Modification of Ritthausen's Method of Determining Proteids. By F. BARNSTEIN (*Landw. Versuchs-Stat.* 1900, 54, 327—336).—Instead of gradually adding sodium hydroxide until the solution is neutral, it is proposed to add a definite volume of aqueous sodium hydroxide, insufficient to completely precipitate the copper. In this manner, the difficulty of exactly neutralising coloured liquids is avoided, and there is a further advantage that the precipitate settles quickly, whilst the liquid filters more easily than is the case with Stutzer's method. The process is as follows.

The substance is boiled with 50 c.c. of water, or, if starchy, is heated for 10 minutes in a water-bath, treated with 25 c.c. of a solution of copper sulphate (containing 60 grams of the crystallised salt per litre); 25 c.c. of aqueous sodium hydroxide (12.5 : 1000) is then added, the liquid being stirred; the supernatant liquid is poured through a filter, the precipitate washed several times by decantation, and finally on the filter. Washing is continued until the solution no longer shows a reaction with potassium ferrocyanide or barium chloride. The nitrogen is then determined by the Kjeldahl process without removing the precipitate from the filter.

A number of results are given agreeing very nearly with those obtained by Stutzer's method. In the case of tea, sugar-beet, lupins, and tobacco, however, somewhat high results are obtained (+0.07 to 0.19 per cent). The results of special determinations showed that asparagine, guanine, and betaine are not precipitated by copper hydroxide. Probably the malt-germ extract with which the substances were mixed kept the guanine in solution (compare Bosshard and Schulze, *Landw. Versuchs-Stat.*, 1887, 33, 132). Tobacco which had been boiled with 40 per cent. alcohol, acidified with acetic acid (Kellner, *Landw. Versuchs-Stat.*, 24, 439) still gave a rather higher result (+0.09 per cent). than by Stutzer's method. The new modification is, however, suitable for most purposes.

As regards peptones, it was found that both with vegetable and animal albumin the precipitation was not complete, but in the modification adopted by the author the copper precipitate contained more nitrogen than was obtained by Stutzer's method. N. H. J. M.

Precipitation of Proteids. By HENRIK SCHJERNING (*Zeit. anal. Chem.*, 1900, 39, 545—566).—In continuation of earlier work on this subject (Abstr., 1896, ii, 631; 1898, ii, 271, 416, 658), the author inquires how far his proposed reagents, and those suggested by others, fulfil the three conditions (I) of giving clear filtrates and washings, (II) of invariably precipitating certain groups of proteids, (III) of precipitating no other nitrogenous organic substances. The reagents investigated (in addition to his own) are (1) Bromine water (Abstr., 1898, ii, 320), (2) tannic acid, (3) Stutzer's copper reagent prepared by Fassbender's method (Abstr., 1881, 205), (4) phosphotungstic acid. Experiments with about 20 different nitrogenous substances show that none of the proposed reagents conforms completely with condition

III, but that the author's six reagents are by far the safest inasmuch as, with the exception of magnesium sulphate, they precipitate very few of these substances, and then in most cases in but small amount. On the other hand, many of these nitrogenous substances are precipitated, and sometimes in large amounts, by bromine water, Stutzer's reagent, and especially by phosphotungstic acid, whilst in other cases precipitates are produced which pass through filter-paper, but would be retained if formed simultaneously with proteid precipitates. Uranium acetate in presence of phosphates and mercuric chloride precipitates ammonia from the acetate. The errors so produced can be avoided by precipitating the phosphoric acid by lead acetate (not in excess) at 50° before adding uranium acetate, or by heating the precipitate with magnesia; the precipitation of ammonia from its acetate by mercuric chloride is prevented by the presence of alkali chlorides, especially ammonium chloride, or the use of mercuric chloride can be avoided altogether by employing lead acetate, which throws down the same proteids. As regards the actual precipitation of proteids by the reagents mentioned, it is shown that bromine water causes very incomplete precipitation and is very liable to give turbid filtrates, that tannic acid and Stutzer's reagent precipitate albumoses and peptones incompletely or not at all, and that phosphotungstic acid in some cases fails to conform with condition II. Laszczynski's proposal to coagulate the proteids by heating at a pressure of $1\frac{1}{2}$ atmospheres is likewise shown to give very imperfect results. In cases where large amounts of salts of the light metals are present all the reagents fail to give quantitative results, with the exception of magnesium sulphate, stannous chloride, and probably Stutzer's reagent and tannic acid.

M. J. S.

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INDEX OF AUTHORS' NAMES.

ABSTRACTS. 1900. Parts I & II.

(Marked A. i and A. ii respectively); and also to Transactions, 1900 (marked T.); and to Proceedings of the Session 1899—1900; Nos. 213 to 226, Nov., 1899—June, 1900 (marked P.).

COMPILED BY MARGARET D. DOUGAL.

A.

- Abderhalden, Emil**, absorption and excretion of iron, A., ii, 223.
 ——— assimilation of iron, A., ii, 289.
 ——— relationship of iron to blood-formation, A., ii, 416.
Abegg, Richard, electrolytic conductivity of pure substances, A., ii, 5.
 ——— heat of dissociation of violuric acid and of water, A., ii, 190.
 ——— silver germ or subhaloid theory, A., ii, 253.
Abegg, Richard, and **Emil Bose**, influence of the addition of a salt with one similar ion on electromotive force and diffusion velocity, A., ii, 127.
Abegg, Richard, and **W. Hers**, separation and identification of acids, A., ii, 436.
Abegg, Richard, and **Cl. Immerwahr**, electrochemical properties of silver fluoride and of fluorine, A., ii, 256.
Abel, John J., epinephrine, A., i, 72.
 ——— phenylcarbamie ester of epinephrine, A., i, 368.
Abel, Rudolf, and **Paul Buttenberg**, action of moulds on arsenic and its compounds; biological proof of the presence of arsenic, A., ii, 299.
Abelous, J. E., and **Ernest Gérard**, co-existence of a reducing enzyme and an oxidising enzyme in the animal organism, A., i, 268.
 ——— transformation of nitrobenzene into aniline by a reducing and hydrogenating enzyme in the animal organism, A., ii, 226.
Aberson, J. H., optical activity of hydroxypruvic acid, A., i, 200.
- Abramson**. See **Carl Adam Bischoff**.
Ach, Friedrich. See **Emil Fischer**.
Achard, Ch., and **A. Clerc**, anti-rennin of serum in pathological conditions, A., ii, 557.
Ackermann, Eug., estimation of ozone from ozonisers of large dimensions, A., ii, 509.
Acree, S. F. See **James R. Bailey**.
Adam, Franz, volumetric estimation of alcohols, especially of fusel oils in "brandies," A., ii, 53.
Adams, Maxwell. See **George M. Richardson**.
Adams, Walter O. See **Augustus H. Gill**.
Adie, Richard Haliburton, sulphates of bismuth, P., 1899, 226.
Adie, Richard Haliburton, and **Kendall Colin Browning**, interaction of sulphuric acid and potassium ferrocyanide, T., 150; P., 1899, 226.
Adie, Richard Haliburton, and **Thomas Barlow Wood**, a new method of estimating potassium, T., 1076; P., 1900, 17.
Adler, Max, effect of nitragin and inoculation soil on yellow lupins, A., ii, 501.
Adrian, L. Alphonse, and **Auguste Trillat**, colouring matter of Digitalis, A., i, 185.
Adriani, J. H., nature of *i*-sorbosose, A., i, 628.
 ——— solidification and transition phenomena of optical antipodes, A., ii, 462.
Afanassoff, action of photographic plates of minerals containing uranium and thorium, A., ii, 702.
Agroskin. See **Carl Adam Bischoff**.
Aguiar, Alberto d'. See **Antonio Joaquim Ferreira da Silva**.

- Ahrens, Felix B.**, heating of, and evolution of chlorine from, bleaching powder purifiers for acetylene, A., i, 1.
— fermentation without cells, A., ii, 610.
- Aignan, A.**, and **E. Dugas**, determination of the solubility coefficients of liquids, A., ii, 68.
- Aigner, F.** See **Josef Hensig**.
- Aitchison, R. S.** See **Diarmid Noël-Paton**.
- Akunoff, J.** See **Georg Lunge**.
- Albanese, Manfredi**, physiological action of 1- and 4-methylxanthines, A., ii, 424.
- Alberda van Ekenstein, William**, and **Cornelis Adriaan Lobry de Bruyn**, some new derivatives belonging to the sugar group, A., i, 619.
- Alberda van Ekenstein, William.** See also **Cornelis Adriaan Lobry de Bruyn**.
- Albert, Friedrich**, [experiments with] cows at Lauchstädt, 1896-1897, A., ii, 103.
- Albert, Robert**, and **Eduard Buchner**, precipitation of zymase from yeast extract, A., i, 320.
— yeast extract and precipitating agents, A., i, 420.
- Albertoni, Pietro**, and **Giusto Coronedi**, the water of Monsummano, A., ii, 90.
- Albo, G.**, physiological functions of solanine, A., ii, 234.
- Albu, A.**, proteid metabolism, A., ii, 151.
- Alden, F. W.**, and **F. G. Ehlert**, estimation of carvone in volatile oils, IV., A., ii, 631.
- Alden, F. W.**, and **S. Nolte**, estimation of carvone in volatile oils, A., ii, 117.
- Alder, Ludwig von**, detection of albumoses in urine, A., ii, 123.
- Aldrich, T. B.**, and **E. M. Houghton**, pharmacology of chlorotone (acetone-chloroform), A., ii, 358.
- Allen, Eugene T.**, hydroxides of aluminium, A., ii, 726.
- Allen, Eugene T.**, and **V. H. Gottschalk**, estimation of aluminium, A., ii, 762.
- Allen, Eugene T.**, and **H. F. Rogers**, action of caustic hydroxides on aluminium, A., ii, 727.
- Allen, Richard William**, the maximum pressure of naphthalene vapour, T., 400; P., 1899, 122.
— the maximum pressure of camphor vapour, T., 413; P., 1899, 135.
— naphthalene vapour in coal gas, A., i, 339.
- Aloy, Jules [François]**, preparation of some uranium oxides, A., ii, 484.
- Alpe, Vittorio**, cultivation of mulberry trees, A., ii, 617.
- Alpers, William C.**, oil and terpenes from *Aralia nudicaulis*, A., i, 107.
- Alsberg, C. L.** See **P. A. Levene**.
- Alvisi, Ugo**, new explosive and detonating materials, A., ii, 205.
- Alvisi, Ugo.** See also **Giovanni Giorgis**.
- Amagat, Emile Hilaire**, specific heats of fluids, A., ii, 525.
- Ameye, Michel**, distillation of dypnone, A., i, 85.
- Amiradibi, S.** See **Wladimir von Gulewitsch**.
- Amthor, Carl**, two deceptive reactions, A., ii, 453.
- Ancona, Giuseppe d'**, *Lotus corniculatus*, A., ii, 161.
— fenugreek, A., ii, 364.
- Anderlini, Francesco.** See **Raffaele Nasini**.
- Anderssen, Justus**, distribution of cane-sugar in plants, A., ii, 561.
- Andersson, J. G.**, and **Naima Sahlbom**, fluorine in Swedish phosphorites, A., ii, 148.
- André, Gustave**, action of sulphur dioxide and hydrogen sulphide on pyridine, A., i, 517.
— changes in the mineral constituents of seed during germination, A., ii, 159.
— changes in the organic constituents of the seed during germination, A., ii, 300.
— some changes produced in etiolated plants, A., ii, 428.
- Andreasch, Rudolf**, methylvioluric acid, and methylidiluric acid, A., i, 479.
- Andrews, Launcelet W.**, new volumetric method for the estimation of silver, A., ii, 760.
- Andriß, Karl**, furfuraldehyde from beet-root and molasses, A., i, 110.
— citric acid in saturation sludge, A., ii, 679.
- Angeli, Angelo**, nitroketones and ortho-nitro-derivatives, A., i, 552.
- Angeli, Angelo**, and **Francesco Angelico**, aromatic nitro-derivatives, A., i, 221.
— nitrohydroxylaminic acid, A., ii, 594.
— reaction of nitroso-derivatives, A., ii, 722.
- Angelico, Francesco**, camphordioximes, A., i, 675.
- Ansel, Otto.** See **Hans von Peehmann**.
- Anselm, Fritz**, and **F. Zuckmayer**, derivatives of naphthalic acid, A., i, 175.
- Anselmino, O.** See **Karl Auwers**.
- Antipoff, J. A.**, meteorites from Jamyscheff and Tubil River, Siberia A., ii, 220.

- Antony, Ubaldo** and **Adolfo Lucchesi**, ruthenium and its compounds, III., A., ii, 659.
- Archbutt, Leonard**, estimation of oxygen in copper by ignition in hydrogen, A., ii, 756.
- Archetti, Andrea**, delicate test for caffeine, A., ii, 121.
- Archibald, E. H.**, test by freezing point determinations of the dissociation values obtained by the conductivity method in the case of solutions of potassium and sodium sulphates, A., ii, 65.
- Arefeff**. See **Nicolai N. Ljubavin**.
- Arendander, E. O.**, effect of food on the quality of milk, A., ii, 236.
- Ark**. See **Hartong van Ark**.
- Armstrong, Edward Frankland**, 3-ethyluric acid, A., i, 636.
- Armstrong, Edward Frankland**. See also **Jacobus Henricus van't Hoff**.
- Armstrong, Henry Edward**, phenylacetylechloramine and its analogues, T., 1047; P., 1900, 160.
- azo- and hydrazone compounds differentiated by bromine, P., 1899, 243.
- note on Bach's hydrogen tetroxide, P., 1900, 134.
- Armstrong, Henry Edward**, and **W. Berry**, meta-sulphonation of aniline, P., 1900, 159.
- Armstrong, Henry Edward**, and **Percy C. C. Isherwood**, bromination of oxyazo-compounds, P., 1900, 158.
- Armstrong, Henry Edward**, and **Edward W. Lewis**, inhibiting effect of etherification on substitution in phenols, P., 1900, 157.
- Armstrong, Henry Edward**, and **Sidney Scrivenner Napper**, benzene-o-disulphonic acid, P., 1900, 160.
- Arndt, Kurt**. See **Georg von Knorre**.
- Arnold, V.**, spectroscopy of the blood, A., i, 127.
- neutral hæmatin, A., i, 318.
- detection of acetic acid in urine, A., ii, 113.
- detection and estimation of acetoacetic acid in pathological urine, A., ii, 768.
- Arons, Leo**, direct combination of aluminium and nitrogen in the electric arc, A., ii, 143.
- Aronstein, Louis**, and **S. H. Meihuizen**, molecular weight of sulphur as determined by the boiling-point method, A., ii, 841.
- Arrhenius, Svante**, change in the strength of weak acids by the addition of salts, A., ii, 201.
- Arrous, J.** See **E. Hédou**.
- Artini, Ettore**, and **Gilberto Melsi**, meteorite from Ergheo, Somaliland, A., ii, 488.
- Aschan, [Adolf] Ossian**, camphane, A., i, 399.
- Aschermann, O. H.**, occurrence of nickel in Silesia, A., ii, 86.
- Aschman, C.**, and **H. Faber**, estimation of humus in soils, A., ii, 60.
- Ascoli, Alberto**, plasmic acid, A., i, 128.
- Asher, Leon**, and **William J. Gies**, properties and formation of lymph, A., ii, 673.
- Asher, Leon**. See also **William J. Gies**.
- Asö, K.**, composition of the spores of *Aspergillus Oryzae*, A., ii, 563.
- Aston, (Miss) Emily [Alicia]**. See **Philippe A. Guye**.
- Aston, William George**. See **John Theodore Hewitt**.
- Astre, Charles**. See **Jules Ville**.
- Astruc, A.**, alkalimetry of the amines, A., i, 141.
- acidimetry of organic polybasic acids, A., i, 199.
- acidimetry, A., ii, 508.
- alkalimetry and acidimetry in volumetric analysis, A., ii, 572.
- Astruc, A.** See also **Henri Imbert**.
- Athanasescu, B.** See **Amé Pictet**.
- Athanasin, J.**, respiration in the frog, A., ii, 288.
- Atkinson, G. A. S.** See **Edgar Philip Perman**.
- Attix, James C.** See **Richard K. Meade**.
- Atwater, Munson D.** See **Henry Lord Wheeler**.
- Atwater, Wiebur Olin**, nutritive value of alcohol, A., ii, 288.
- Aubel, Edmond van**, indices of refraction of metals, A., ii, 125.
- change of thermal conductivity during melting, A., ii, 128.
- Auchy, George**, retention of water by asbestos, A., ii, 309.
- estimation of graphite by loss, A., ii, 313.
- estimation of carbon in steel, A., ii, 574.
- Auden, Harold Alden**, some new osazones and tetrazones, P., 1899, 229.
- Auger, Victor**, new method for the preparation of nitromethanes, A., i, 578.
- diphenylmethyl oxide, A., i, 594.
- Austin, Martha**, double ammonium phosphates of beryllium, zinc, and cadmium in analysis, A., ii, 49.
- constitution of the ammonium magnesium arsenate of analysis, A., ii, 245.
- Austin, Martha**. See also **Frank Austin Gooch**.
- Austin, Rollan M.** See **Louis Kahlenberg**.

- Autenrieth, Wilhelm**, and **P. Rudolph**, action of phosphorus thiochloride on aromatic amines in the presence of alkali, A., i, 570.
- Autenrieth, Wilhelm**, **P. Rudolph**, [and in part **O. Hildebrand**], preparation of phosphoryl derivatives of aromatic amines, A., i, 570.
- Auwers, Karl**, α -hydroxy- α -methylisohexylacetic acid [α -hydroxy- α -dimethylheptic acid], A., i, 9.
- bromophenols insoluble in alkalis, A., i, 96.
- bromophenols from *as-o*-xyleneol and *as-m*-xyleneol, A., i, 96.
- relation between the structure of *m*-phenol [*m*-hydroxybenzyl] haloids and their behaviour towards alkalis, A., i, 159.
- action of chloroform and alkalis on 1:3:4-xyleneol, A., i, 160.
- oxidation products of phenols and bromophenols, and the constitution of the isomeric tribromo- ψ -cumenol, A., i, 161.
- intramolecular rearrangement, A., i, 492.
- Auwers, Karl**, and **O. Anselmino**, degradation of phenols during bromination, A., i, 159.
- Auwers, Karl**, [and in part **W. Bartsch**, **F. H. Betteridge**, **Max Dohrn**, and **H. M. Smith**], cryoscopic observations, A., ii, 262.
- Auwers, Karl**, [with **W. Bartsch** and **H. M. Smith**], influence of the solvent on the cryoscopic behaviour of phenols, A., ii, 66.
- Auwers, Karl**, and **J. Broicher**, [and in part **W. Wolff**], oxidation products of phenols and bromophenols, A., i, 162.
- Auwers, Karl**, and **Harry Burrows**, [with **H. van de Bovaart**], heptabromoderivative of *as-o*-xyleneol, A., i, 98.
- Auwers, Karl**, and **S. Daecke**, action of bromine on *p*-hydroxybenzyl alcohol, A., i, 164.
- Auwers, Karl**, [and **Max Dohrn**], cryoscopic researches on the constitution of acid amides, A., ii, 184.
- Auwers, Karl**, and **A. Ebner**, oxidation products of tribromo- ψ -cumenol, A., i, 161.
- Auwers, Karl**, and **R. (Freiherr) von Erggelet**, [and in part **H. van de Bovaart** and **W. Wolff**], pentabromoderivative of *as-o*-xyleneol, A., i, 97.
- Auwers, Karl**, and **W. Hampe**, pentabromide from [pentabromo-derivative of] *as-m*-xyleneol, A., i, 96.
- Auwers, Karl**, and **Th. Maas**, dibromo-*m*-hydroxy- ψ -cumyl bromide, A., i, 162.
- Auwers, Karl**, [and **G. Mann**], constitution of hydroxyazo-compounds, A., i, 418.
- Auwers, Karl**, [with **Fritz Mayer**, and **F. Schleicher**], amic acids and imides of aliphatic dicarboxylic acids, A., i, 84.
- Auwers, Karl**, and **W. Richter**, action of bromine on *m*-hydroxybenzyl alcohol, A., i, 165.
- Auwers, Karl**, and **F. A. Traun**, dibromo-*p*-hydroxymesityl alcohol, A., i, 167.
- Auwers, Karl**, **F. A. Traun**, and **R. Welde**, tribromo-derivatives of ψ -cumenol and mesitol, A., i, 165.
- substituted phenyl benzyl ethers, A., i, 168.
- Ausenat, R.**, estimation of iodic acid in sodium nitrate, A., ii, 366.

B.

- Babcock, S. Moulton**, and **H. L. Russell**, galactase, the proteolytic ferment peculiar to milk, its properties, and action on the proteids of milk, A., i, 712.
- Babcock, S. Moulton**, **H. L. Russell**, and **Alfred Vivian**, antiseptic value of certain chemicals in milk, A., ii, 560.
- Bach, A.**, higher hydrogen peroxides, A., ii, 470.
- Bachofen, F.**, ash of cocoanut, A., ii, 302.
- Bachofen, F.** See also **A. Bain**.
- Badel, E.** See **Henri Lambert**.
- Baessler, Paul**, field experiments for determining the general manurial requirements of typical soils with reference to chemical soil analysis, A., ii, 240.
- field experiments with superphosphate and basic slag, A., ii, 307.
- field experiments with potash-lime manure and fish guano, A., ii, 308.
- experiments on the Schultz-Lupitz system, A., ii, 504.
- Baeyer, Adolf von** [with **Otto Seuffert**], orientation in the terpene series, XXIV., A., i, 132.
- Baeyer, Adolf von**, and **Victor Villiger**, action of Caro's reagent on ketones, A., i, 133, 206, 328.
- benzoyl hydrogen peroxide; oxidation of benzaldehyde in air, A., i, 437.
- nomenclature of the peroxides; aldehydic peroxides, A., i, 626.
- action of permanganate on hydrogen peroxide and on Caro's acid, A., ii, 719.
- Bailey, James R.**, and **S. F. Acree**, 3-hydroxy-5-alkyl-1:2:4-triazolepropionic acids, A., i, 528.

- Ballinsk, K.** See *Wladimir B. Markownikoff*.
- Baillie, Thomas B., and Julius Tafel,** deoxycaffeine, A., i, 121.
- Bain, A., and F. Bachofen,** composition of cocoanut ash, A., ii, 497.
- Baker, H. Brereton,** vapour density of dried mercurous chloride, T., 646; P., 1900, 68; discussion, P., 68.
- Baker, Julian Lovell, and Thomas Henry Pope,** mannogalactan and laevulomannan; two new polysaccharides, T., 696; P., 1900, 72.
- Baker, T. J.,** heat of combination of copper with zinc, P., 1899, 195.
- Bakker, G.,** theory of capillarity, A., ii, 466.
- Balachowski, Dmitri,** electrolytic estimation of bismuth, A., ii, 578.
— electrolytic estimation of cadmium, A., ii, 688.
- Balbiano, Luigi,** camphoric acid, A., i, 202.
- Balbiano, Luigi, and D. Trasciatti,** new derivative of glycine, A., i, 632.
- Baldwin, de Forest.** See *Frank A. Gooch*.
- Baldy, F.,** examination of aluminium and zinc by solution in hydrochloric acid, A., ii, 690.
- Balthazard, W.** See *H. Claude*.
- Baly, Edward C. C.,** distillation of liquid air, and the composition of the gaseous and liquid phases. I. At constant pressure, A., ii, 589.
- Bamberger, Eugen,** history of diazonium salts, A., i, 193.
— oxidation of aqueous solutions of aromatic hydroxylamines by atmospheric oxygen, A., i, 220.
— oxidation of benzaldoxime, A., i, 500.
— relationship between azoxybenzene and diazobenzene, A., i, 531.
— action of aqueous sodium hydroxide on nitrosobenzene, A., i, 531.
— Caro's reagent, A., ii, 536.
- Bamberger, Eugen,** [and in part with *Marie Baum, l'Orsa, Armand Stiegelmann, and Fred. Tschirner*], action of formaldehyde on β -aromatic hydroxylamines, A., i, 341.
- Bamberger, Eugen, and Friedrich Brady,** action of alkalis on aromatic hydroxylamines, A., i, 221.
- Bamberger, Eugen, and G. Djierdjian,** pyrrolealdehyde, A., i, 309.
- Bamberger, Eugen, and Adolf Hill,** oxidation of aromatic iodides, A., i, 281.
- Bamberger, Eugen, and Ernst Hoff,** direct introduction of nitro-groups into the side chain of aromatic amines, A., i, 435.
— dehydration of amine nitrates to nitramines (diazoic acids), A., i, 435.
- Bamberger, Eugen, and Jens Müller,** action of nitric peroxide on mercury-dimethyl, A., i, 145.
— nitrosoamines of methylated nitroanilines, A., i, 217.
— new method of preparing isodiazotates, A., i, 705.
- Bamberger, Eugen, Otto Schmidt, and Herbert Levinstein,** action of diazobenzene on nitromethane, A., i, 566.
- Bamberger, Eugen, and Armand Stiegelmann,** action of aromatic nitroso-derivatives on α -alkylaromatic hydrazines, A., i, 193.
- Bamberger, Eugen, and Fred. Tschirner,** action of diazomethane on β -aromatic hydroxylamines, A., i, 342.
— oxidation of aniline, A., i, 435.
- Bamberger, Max, and Anton Landsiedl,** natural resins [Ueberwallungsharze], A., i, 48.
— erythritol in *Trentepohlia Jolithus*, A., i, 579.
- Bamberger, Max, and Emil Vischner,** natural resins [Ueberwallungsharze]. VI. Dry distillation of lariciresinol, A., i, 605.
- Bancroft, Wilder Dwight,** the dilution law, A., ii, 186.
— hydrates in solution, A., ii, 195.
— isohydric solutions, A., ii, 529.
- Bang, Ivar,** parachymosin, A., ii, 356.
- Barbéra, A. G.,** influence of iodine, sodium iodide, and iodothyron on the circulation, A., ii, 291.
- Barbier, Philippe,** citral and its isomeric forms, A., i, 508.
- Barbieri, N. Alberto,** chemistry of the brain, A., ii, 671.
- Barcroft, Joseph,** gaseous metabolism of the submaxillary gland, A., ii, 417.
- Barnes, Bayard.** See *H. Lord Wheeler*.
- Barnes, H. T.,** inversion of hepta- and hexa-hydrates of zinc sulphate in the Clark cell, A., ii, 254.
— the Weston cell as a transition cell, and as a standard of electromotive force, with a determination of the ratio to the Clark cell, A., ii, 520.
- Barnes, James,** conductivity, specific gravity, and surface tension of aqueous solutions containing potassium chloride and sulphate, A., ii, 332.
— conductivity of aqueous solutions of hydrochloric and sulphuric acids, A., ii, 522.
— depression of the freezing point by mixtures of electrolytes, A., ii, 526.
- Barnett, E. A.** See *Edgar Francis Smith*.
- Barnstein, F.,** modification of Ritt-hausen's method of determining proteids, A., ii, 779.

- Barnstein, F.** See also *Oscar Kellner*.
- Barr, Edwin de**, action of water on certain fatty acids, A., i, 76.
- Barrie, Thomas S.**, estimation of potassium iodide, A., ii, 755.
- Barth, Georg**, bitter principles of hops, A., ii, 746.
- Barthe, Léonce**, ammonium earthy phosphates, A., ii, 480.
- Barthel, Chr.**, researches on the formation of acetic acid by Bacteria producing lactic acid, A., ii, 742.
- Bartlett, James Monroe**, effect of food on the hardness of butter, and composition of butter-fat, A., ii, 567.
- effect of feeding with fat on the percentage of fat in the milk, A., ii, 568.
- Bartsch, W.** See *Karl Auwers*.
- Bary, Paul**, fluorescence of metallic compounds under the influence of Röntgen and Becquerel rays, A., ii, 330.
- Baschieri, A.**, behaviour of acetylene on oxidation, A., i, 534.
- Beakerville, Charles**, universal distribution of titanium, A., ii, 226.
- analysis of titaniferous iron ores, A., ii, 629.
- Basewies.** See *Carl Adam Bischoff*.
- Bataillon, E.**, action of increased osmotic pressure on the ovum, A., ii, 554.
- Batelli, Angelo**, and *A. Stefanini*, cryoscopic and ebullioscopic researches, A., ii, 709.
- Bau, Arminius**, crystallised melibiose, A., i, 77.
- fermentation experiments with trehalose, A., ii, 98.
- Baud, E.**, action of anhydrous aluminium chloride on acetylene, A., i, 369.
- Baudran, G.**, [tartar] emetics, A., i, 875.
- Bauer, Hans.** See *Richard Stoermer*.
- Bauer, K.**, experimental petrology, A., ii, 26.
- Bauer, Paul.** See *Max Busch*.
- Bauer, Wilhelm.** See *Hans von Pechmann*.
- Baugé, Georges**, double carbonates of chromium oxide; saline oxide of chromium, A., ii, 349.
- Baum, Fritz**, theory of narcosis, A., ii, 156.
- Baum, Marie.** See *Eugen Bamberger*.
- Baur, E.** See *Wilhelm Muthmann*.
- Baur-Thurgau, Albert**, derivatives of butylxylene [1:3-dimethyl-5-butylbenzene], A., i, 639.
- Baur-Thurgau, Albert**, and *August Bischler*, aldehyde-musk, A., i, 178.
- Baxter, Gregory Paul**, occlusion of hydrogen by cobalt and other metals, A., ii, 78.
- Baxter, Gregory Paul.** See also *Theodore William Richards*.
- Bayley, Thomas**, relation between boiling point and melting point in the hydrocarbons, A., i, 369.
- atomic weights and physical properties, A., ii, 188.
- Baslen, Max.** See *August Bernthsen*.
- Beatty, L. O.** See *J. H. Kastle*.
- Beatty, W. A.** See *J. H. Kastle*.
- Beck, Carl**, estimation of cellulose, A., ii, 448.
- Beck, O. C.**, and *Henry Fisher*, separation and estimation of arsenic and antimony in ores, A., ii, 312.
- Beck, Richard**, tin ores from Banca and Billiton, A., ii, 734.
- Beckmann, Ernst [Otto]**, lamps for spectra, I., A., ii, 701.
- Beckmann, Ernst**, [and *H. Brüggemann*], estimation of fusel oil in alcoholic liquids, A., ii, 175.
- Beckurts, Heinrich**, amount of alkaloids in the bark of Java pomegranates, A., ii, 563.
- Beckurts, Heinrich.** See also *Gustav Frerichs*.
- Becquerel [Antoine], Henri**, phosphorescence phenomena produced by the radiations from radium, A., ii, 126.
- influence of the magnetic field on the rays emitted by radio-active substances, A., ii, 126.
- radiation of radio-active substances, A., ii, 126.
- radiations from radium, A., ii, 182.
- dispersion of the radiation of radium in a magnetic field, A., ii, 183.
- transparency of aluminium to radiations from radium, A., ii, 381.
- uranium radiation, A., ii, 518.
- Beddies, Alfred**, permanent forms of nitric and nitrous organisms, A., ii, 34.
- Beddow, Frederick.** See *Siegfried Ruhemann*.
- Bedson, Peter Phillips**, New Zealand coal and ambrite; Barbados manjak, A., ii, 20.
- Beermann, Heinrich**, composition of tourmaline, A., ii, 663.
- Béhal, Auguste**, mixed anhydrides of acyclic and cyclic acids, A., i, 8.
- mixed anhydrides of formic acid, A., i, 580.
- Behn, Heinrich.** See *August Michaelis*.
- Behn, U.**, specific heat of metals at low temperatures, A., ii, 259.

- Behn, U.**, specific heat of metals, graphite, and a few alloys at low temperatures, A., ii, 259.
 — heat of sublimation of carbon dioxide, and heat of vaporisation of air, A., ii, 260.
- Behrend, Robert**, and *Emil Dietrich*, constitution of β -methyluric acid, A., i, 120.
- Behrend, Robert**, and *Richard Grünwald*, aminouracil, A., i, 63.
- Behrend, Robert**, and *Fred. C. Meyer*, action of phenylcarbimide on ethyl β -aminocrotonate, A., i, 287.
- Behrend, Robert**, and *Hermann Schreiber*, ethyl β -bromoaminocrotonate, A., i, 210.
- Behrendsen, O.**, behaviour of radium at low temperatures, A., ii, 587.
- Behrens, Johannes**, tobacco plant, A., ii, 239.
 — presence of vanillin in vanilla, A., ii, 679.
- Behrens, Theodor Heinrich**, some anomalies in Mendelëeff's system, A., ii, 136.
 — isomorphous compounds of gold and mercury, A., ii, 213.
- Beljeringek**. See *Beyerinck*.
- Bein, Sigismund**, examination of commercial pastry, A., ii, 460.
- Belakowski**. See *Carl Adam Bischoff*.
- Bellen, E. van der**, asbestos [and chrysotile], A., ii, 602.
- Bellier, J.**, colour tests for sesamé oil, and three new characteristic tests, A., ii, 117.
 — rapid estimation of the iodine number of fats, A., ii, 632.
- Belloq, A.**, albumin in normal urine, A., ii, 556.
 — estimation of uric acid, A., ii, 695.
- Bellucci, I.** See *Arturo Miolati*.
- Belugou, Guillaume**. See *Henri Imbert*.
- Bemmelen, Jacobus Martinus van**, absorption. VI. Absorption of matters from solution, A., ii, 466.
- Bemmelen, Jacobus Martinus van**, [with *C. Hoitsema* and *E. A. Klobbie*], accumulation of iron in peat, A., ii, 215.
- Bemmelen, Jacobus Martinus van**, and *Edvard August Klobbie*, absorption of hydrogen chloride and potassium chloride from aqueous solution by colloidal stannic oxide, A., ii, 338.
- Bémont, Gustave**. See *P. Curie*.
- Bender, Carl**, refraction of normal salt solutions, A., ii, 461.
- Bendix, Ernst**, and *Julius Wohlgemuth*, preparation of pure glycogen, A., ii, 491.
- Bénésh, Elophe**, action of phenylcarbimide and phenylthiocarbimide on dibasic acids, A., i, 340.
- Benedicenti, Alberico**, and *Oreste Folledro*, [physiological action of] mercury derivatives of aromatic amines, A., ii, 359.
- Benedicks, Carl**, gadolinium, A., ii, 209.
- Benedict, Francis Gano**, absorption apparatus for elementary organic analysis, A., ii, 439.
 — elementary analysis of organic substances containing nitrogen, A., ii, 439.
 — distillation of ammonia in the estimation of nitrogen, A., ii, 573.
- Benedict, Francis Gano**, and *Emil Osterberg*, elementary composition and heat of combustion of human fat, A., ii, 491.
- Benoit, E.**, hydro-gasometer and urinometer, A., ii, 435.
- Benrath, A.** See *Robert Stollé*.
- Bentley, William B.**, action of nitric acid on vanillin, A., i, 552.
- Berg, Armand**, action of iodides and of hydriodic acid on sulphur dioxide, A., ii, 535.
- Bergell, Peter**, preparation of lecithin, A., i, 621.
- Bergell, Peter**, and *Ferdinand Blumenthal*, isolation of pentose and methyl-pentose [from urine], A., ii, 373.
- Bergin, T. J.** See *Benjamin Moore*.
- Berlios, F.**, the influence of "saccharin" [o-benzoesulphinide] on digestion, A., ii, 606.
- Bernthsen, August**, and *Max Baslen*, hyposulphurous acid, A., ii, 203.
- Berry, W.** See *Henry Edward Armstrong*.
- Bertarelli, E.**, nutritive value of margarine compared with butter, A., ii, 224.
- Berté, E.** See *Arturo Soldaini*.
- Berthault**, distribution of manures, A., ii, 753.
- Berthelot, Daniel**, minimum volume of liquids, A., ii, 335.
 — molecular association in liquids, A., ii, 337.
 — law of corresponding states, A., ii, 646.
 — boiling points of zinc and cadmium, A., ii, 654.
- Berthelot, Marcellin** [*Pierre Eugène*], simultaneous oxidation and hydration of organic compounds under the influence of light and oxygen, A., i, 3.
 — behaviour of diamines on neutralisation, A., i, 83.
 — diamines; diethylenediamine (piperazine), A., i, 83.
 — decomposition of alkyl nitrates and nitroglycerol by alkalis, and the relative stability of explosives, A., i, 620.
 — compound metallic radicles; mercury derivatives, A., ii, 129.

- Berthelot, Marcellin**, explosion of potassium chlorate, A., ii, 139.
 — ultimate analysis of organic compounds, A., ii, 172.
 — [thermochemistry of] the uric acid series, A., ii, 189.
 — isomerism of thiocyanic derivatives, A., ii, 261.
 — chemical action of light contrasted with that of the silent discharge, A., ii, 329.
 — specific heat of blood, A., ii, 357.
 — heats of combustion and formation of iodine compounds, A., ii, 387.
 — formation of nitric acid during combustion: carbon, A., ii, 475.
 — formation of nitric acid during combustion; sulphur, metals, A., ii, 475.
 — formation of nitric acid during the combustion of hydrogen, A., ii, 538.
 — absorption of free oxygen by normal urine, A., ii, 740.
 — acidity of urine, A., ii, 741.
Berthelot, Marcellin, and **Marcel Delépine**, iodide of cuprous acetylide, A., i, 324.
 — — lactic acid, A., ii, 130.
 — — heat of combustion of very volatile liquids, A., ii, 334.
Berti, P. See *Giuseppe Bruni*.
Bertiaux, L. See *Auguste Hollard*.
Bertossi, V. See *Girolamo Massara*.
Bertram, Julius, and **J. Helle**, isofenchyl alcohol, A., i, 398.
Bertrand, Gabriel, oxidation of erythritol by the sorbose bacterium; production of erythrulose, a new sugar, A., i, 377.
 — reduction of erythrulose and preparation of a new erythritol: *d*-erythritol, A., i, 424.
 — presence of mannocellulose in ligneous tissues, A., ii, 160.
Besredka, rôle of leucocytes in poisoning by compounds of arsenic, A., ii, 156.
 — leucotoxin, A., ii, 741.
Besredka. See also *Élie Metchnikoff*.
Besson, [Jules] Adolphe, the lower oxides of phosphorus, A., ii, 539.
Best, Hans. See *Richard Jos. Meyer*.
Betteridge, F. H. See *Karl Auwers*.
Betti, Mario. See *Hugo Schiff*.
Beutal, Ernst, tolyldiguanides and benzyldiguanide, A., i, 367.
Bevan, Edward John. See *Charles Frederick Cross*.
Bewad, Ivan I., action of zinc alkyls on nitrous esters and nitroparaffins, A., i, 629.
Beyerinck, Martinus Willem, glucosides and enzymes contained in the root of some *Spireas*, A., i, 108.
Beyerinck, Martinus Willem, formation of indigotin from wood (*Isatis tinctoria*), A., i, 230, 649.
 — indigo fermentation, A., i, 403.
 — production of quinone by *Streptothrix chromogena*, and the biology of this microbe, A., ii, 425.
Beythien, Adolf, Paul Behrisch, and **Joseph Deiter**, examination of tea, A., ii, 455.
Beythien, Adolf, and **Hans Hempel**, accuracy of Jørgensen's method for estimating boric acid in preserved meat, and the separation of boric acid from borax, A., ii, 313.
Biddle, Henry C., derivatives of the isuretine of formhydroxamic acid and their relation to fulminic acid, A., i, 137.
Biedermann, K. See *Paul Jannasch*.
Bigelow, Samuel Lawrence, a simplification of Beckmann's boiling point apparatus, A., ii, 9.
Bignami, Carlo, and **Giuseppe Testoni**, oil of parsley, A., i, 400.
Billmann, Einar, preparation of acrylic acid from allyl alcohol, A., i, 425.
 — action of allyl alcohol and of ethylene on mercuric salts, A., i, 431.
 — action of allyl alcohol on potassium platinochloride, A., i, 543.
 — preparation of sodium cobalt nitrite, and its employment for the detection of potassium, A., ii, 624.
Billmann, Einar, [and in part *Bjerrum*], anhydrous acrylic acid, A., i, 473.
Billmann, Einar, and **Alfred Wähle**, methods for the preparation of acrylic acid, A., i, 425.
Bijl, H. C. See *Cornelis Adriaan Lobry de Bruyn*.
Bijlert, A. van, action of very dilute nitric acid [on metals], A., ii, 204.
Billitzer, Jean, affinity coefficients of saturated fatty acids, A., i, 7.
Bilts, Heinrich, oxidation with atmospheric oxygen, A., i, 662.
 — colour changes of illuminated substances, A., ii, 125.
Bilts, Heinrich, and **Erich Kedesdy**, nitrotriiodoethylene and dinitrodiiodoethylene, A., i, 534.
Bins, A., and **A. Hagenbach**, reducing action of electrolytically deposited metals, A., ii, 384.
Bins, A., and **F. Rung**, [crystalline indigo-white], A., i, 560.
Bins, A. See also *L. Preuss*.
Biron, Eugen von, thermal capacity of solutions of sulphuric acid, A., ii, 63.
 — hydrates of sulphuric acid, A., ii, 74.
Biron, Eugen von. See also *Otto Wallach*.

- Bisclier, August.** See **Albert Baur-Thurgau.**
- Bischoff, Carl Adam,** formation of chains. XLII. Phenoxypropionic acids and their derivatives, A., i, 345.
- formation of chains. XLIII. α -Phenoxy -butyric, -isobutyric, and -isovaleric acids and their esters, A., i, 345.
- formation of chains. XLIV. The three sodium tolyloxides and ethyl esters of α -bromo-fatty acids, A., i, 392.
- formation of chains. XLV. Sodium xylyloxides and ethyl esters of α -bromo-fatty acids, A., i, 393.
- formation of chains. XLVI. Sodium derivatives of carvacrol, thymol, and ψ -cumenol and ethyl esters of α -bromo-fatty acids, A., i, 394.
- formation of chains. XLVIII. Guaiacol derivatives, A., i, 396.
- formation of chains. LII. Derivatives of catechol, A., i, 445.
- Bischoff, Carl Adam** [and in part **Abramson, Agroskin,** and **Minski**], formation of chains. LIII. Derivatives of resorcinol and orcinol, A., i, 446.
- Bischoff, Carl Adam** [and in part **Bassewicz, Dunin-Sulgiatowski, Olzowski,** and **Stielmann**], formation of chains. LIV. Derivatives of quinol, A., i, 446.
- Bischoff, Carl Adam** [and in part **Belakowski, Guntrum, Koch, Krusenstiern, Mergenthaler, Ronthal,** and **Rauchowski**], formation of chains. XLIX. Derivatives of the three ethyl hydroxybenzoates, A., i, 396.
- Bischoff, Carl Adam** [and in part **Con, Dowgallo, Kisliansky, Lipschitz, Siw,** and **Slobodskoi**], formation of chains. XLVII. Sodium naphthyloxides, and ethyl esters of α -bromo-fatty acids, A., i, 395.
- Bischoff, Carl Adam** [and in part **Fränkel, Gohs,** and **Wengel**], formation of chains. L. The three sodium nitrophenoxides, A., i, 442.
- Bischoff, Carl Adam** [and in part **Herr, Jentschmen,** and **Seyrotshkin**], formation of chains. LI. Chloro- and bromo-phenols. Summary of quantitative results on the condensation of phenols, A., i, 443.
- Bistrzycki, Augustin,** oxidation of hydrazobenzene in alkaline alcoholic solution by atmospheric oxygen, A., i, 315.
- Bittner, Karl.** See **Rudolf Wegscheider.**
- Bittó, Béla von,** soil investigations in the Tokay wine district, A., ii, 751.
- Bjerrum.** See **Einar Billmann.**
- Bjerrum, Kirstine.** See **Kirstine Meyer.**
- Blackman, Waller Lionel.** See **Kennedy Joseph Previle Orton.**
- Blagden, J. W.** See **Arthur Hantzsch.**
- Blaise, Edmond E.,** β -hydroxy- $\alpha\alpha\beta$ -trimethyladipic acid, A., i, 329.
- $\alpha\beta$ -dimethylglutolactonic acid, A., i, 474.
- Blaise, Edmond E.,** and **G. Blanc,** camphenylone, A., i, 183.
- Blake, Robert Frederick.** See **Edmund Albert Letts.**
- Blanc, G.,** action of aluminium chloride on camphoric anhydride, A., i, 133, 586.
- amines containing the camphor nucleus, A., i, 239.
- constitution of isolauronic acid, A., i, 329.
- campholytic and isolauronolic acids, A., i, 581.
- Blanc, G.** See also **Edmond E. Blaise** and **Albin Haller.**
- Blankenhorn, Max,** a new mineral from near Cassel, A., ii, 736.
- Blankens, J. J.,** action of sodium mono- and di-sulphides on aromatic nitro-compounds, A., i, 226.
- general method for preparing sulphonic derivatives by means of disulphides, A., i, 482.
- Blaser, Hermann,** detection of acetaldehyde in ether, A., ii, 179.
- Blattner, N.,** and **J. Brasseur,** estimation of potassium perchlorate in alkali nitrates (nitre and Chili saltpetre), A., ii, 755.
- process for the estimation of chlorides, chlorates, and perchlorates in the presence of each other, A., ii, 755.
- Blaugberg, Magnus,** mineral metabolism in the naturally and artificially fed infant, A., ii, 669.
- Bleier, Otto,** and **Leopold Kohn,** determination of vapour density under arbitrary pressure, II., A., ii, 192.
- molecular weight and vapour density of sulphur, A., ii, 203, 721.
- Bloch, M.,** and **Stanislaus von Kostanetski,** 2-methyl-7-hydroxypheno-3-pyrone (2-methyl-7-hydroxychromone), A., i, 308.
- 2-methylchromone, A., i, 502.
- Blount, Bertram,** estimation of carbon and sulphur in steel, A., ii, 574.
- Bloxam, William Popplewell,** hydrosulphides, sulphides, and polysulphides of potassium and sodium, T., 753; P., 1899, 146.
- Blum, Fritz,** the iodine number of proteids, A., i, 67.

- Blum, Fritz**, the thyroid as a poison-removing organ, A., ii, 224.
- Blum, L.**, direct estimation of calcium in presence of iron and aluminium, A., ii, 511.
- estimation of iron in tap cinder, A., ii, 512.
- Blum, Leon**, nutritive value of heteroalbumose from fibrin, and protoalbumose from casein, A., ii, 667.
- Blumenthal, Ferdinand**, estimation of hippuric acid, A., ii, 770.
- Blumenthal, Ferdinand**. See also *Peter Bergell*.
- Blumstein, J.**, and *Stanislaus von Kostanecki*, 6:3'-dihydroxyflavone, A., i, 448.
- Blythwood, Lord**, and *E. W. Marchant*, absorption of Röntgen's rays by aqueous solutions of metallic salts, A., ii, 182.
- Bocchi, O.**, action of bromoform and chloroform on some pyrroles, A., i, 357.
- Bock, Johannes**, action of caffeine and theobromine on the heart, A., ii, 424.
- Bode, Adolf**. See *Richard Willstätter*.
- Bode, G.**, phylloxanthin, A., i, 109.
- chlorophyll, A., i, 109.
- Bodenstein, Max**, gaseous reactions in chemical kinetics, VI. and VII., A., ii, 12.
- false equilibrium, A., ii, 136.
- Bodländer, Guido**, solubility of carbonates of alkaline earths in water containing carbon dioxide, A., ii, 715.
- Bodmer, Richard**, *Norman Leonard*, and *Harry Metcalfe Smith*, analysis of golden syrup, A., ii, 320.
- Bodroux, F.**, transformation of phenyl, *p*-tolyl, and thymyl acetates into the corresponding benzoates, A., i, 224.
- lead and copper polysulphides, A., ii, 480.
- mercury chlorosulphide, A., ii, 481.
- direct formation of crystallised mercuric and mercurous iodides, A., ii, 543.
- Böcker, Th.** See *Otto Wallach*.
- Boeggild, O. B.**, steenstrupine, A., ii, 418.
- epistolite, a new mineral, A., ii, 414.
- Boehm, Carl**. See *Hermann Pauly*.
- Böhm, R.** See *Wilhelm Muthmann*.
- Boekhout, F. W. J.**, micro-organisms forming dextran, A., ii, 742.
- Bömer, A.**, [and *K. Winter*], detection of sesamé oil, A., ii, 178.
- Boeris, Giovanni**, crystalline form of tolane, A., i, 544.
- perowskite from S. Ambrogio in the Valley of the Susa, A., ii, 600.
- Boes, Johannes**. See *Richard Stoermer*.
- Boeseken, J.**, Friedel and Crafts' reaction, A., i, 849.
- Böttcher, O.**, value of lime compounds in phosphatic manures, A., ii, 106.
- Böttger, Wilhelm**, estimation of manganese as pyrophosphate, A., ii, 448.
- Böttger, Wilhelm**. See also *Wilhelm Kerp*.
- Bötttinger, Carl**, glycollic and glyoxylic acids, A., i, 582.
- yeast, A., ii, 33.
- detection of aldehyde in vinegar prepared by fermentation, A., ii, 773.
- Bogdanoff, Sergei M.**, amount of sulphur in plants, A., ii, 160.
- Bogert, Marston Taylor**, and *August Henry Gotthelf*, direct synthesis of ketodihydroquinazolines from ortho-amino-acids, A., i, 412, 608.
- Boguski, Jossif Surt**, properties of solutions of sodium nitrite, A., ii, 75.
- Bohr, Christian**, solubility of carbon dioxide in alcohol between -67° and $+45^{\circ}$: invasion and evasion coefficients at 0° , A., ii, 267.
- Bohrisch, Paul**. See *Adolf Beythien*.
- Bokorny, Thomas**, decomposition of proteids by acids, A., i, 126.
- effect of different substances on the curdling of milk, A., ii, 297.
- occurrence of albumin, albumose, and peptone in the vegetative portions of plants, A., ii, 426.
- myrosin, A., ii, 746.
- Bolam, Herbert William**. See *Alexander Crum Brown*.
- Boland, G. W.**, pyocyanin, the blue colouring matter of *Bacillus pyocyaneus*, A., i, 70.
- Bonavia, Aldo**. See *Giuseppe Plancher*.
- Bone, William Arthur**, and *Charles H. G. Sprankling*, researches on the alkyl-substituted succinic acids, II. *s*-Dipropyl-, *s*-diisopropyl-, and *aa*-propylisopropyl-succinic acids, T., 654; P., 1900, 71.
- researches on the alkyl-substituted succinic acids. Part III. Dissociation constants, T., 1298; P., 1900, 184.
- Bongarts, J.** See *Stanislaus von Kostanecki*.
- Bonjean, Edmond**, mineral water from the cold, or "Park" Spring at Evaux-les-Bains (Creuse), A., ii, 488.
- mineral water from the Brault No. 3 Spring at Sail-sous-Couzan (Loire), A., ii, 488.
- Bonneau, R.** See *A. Richaud*.
- Bonnefoi, J.**, compounds of lithium chloride with ethylamine, A., ii, 130.

- Bonnefoi, J.**, combination of lithium bromide with gaseous ammonia, A., ii, 478.
- Boorsma, S. E.**, curangin, the glucoside of *Curanga amara*, A., i, 243, 304.
- Bordet, Jules**, hæmolytic serums, A., ii, 741.
- Bordier, H.**, specific heat of blood, A., ii, 356.
- Bornträger, Hugo**, rapid solution of ignited ferric oxide in hydrochloric acid, A., ii, 171.
- detection of boric acid in borates, A., ii, 439.
- analysis of molybdenum alloys, A., ii, 444.
- simple distinction between glue and dextrin or gum arabic, A., ii, 630.
- infected phosphates, A., ii, 684.
- analysis of phosphor-copper, A., ii, 689.
- rapid assay of tungsten ores and residues, A., ii, 692.
- simple analysis of wool fat, A., ii, 773.
- analysis of gutta percha, A., ii, 775.
- Bornsche, Walther**, action of benzene-diazonium chloride on alkaline solutions of nitrosophenol, A., i, 24, 594.
- benzeneazosalicylaldehyde, A., i, 419.
- constitution of metapurpuric acid, A., i, 645.
- Boruttau, H.**, physiology of the suprarenal capsules, A., ii, 225.
- Boscá y Casanoves, Eduardo**, meteorite from Quesa, Spain, A., ii, 415.
- Bosch, W.** See **Karl A. Hofmann**.
- Bose, Emil**, electromotive efficiency of the elementary gases. I., A., ii, 704.
- Bose, Emil**. See also **Richard Abegg**.
- Bottazzi, Filippo**, and **I. Cappelli**, sodium and potassium in the red corpuscles of the blood of animals of different species, and in cases of anæmia caused by bleeding, A., ii, 225.
- sodium and potassium in the red corpuscles of the blood during fasting, phosphorus poisoning, etc., A., ii, 225.
- Bottomley, J. Frank**, and **William Henry Perkin, jun.**, condensation of formaldehyde with ethyl malonate, and synthesis of pentamethylene-1:2:4-tricarboxylic acid, T., 294; P., 1900, 16.
- Bouehard, Charles**, and **Alexandre Desgros**, transformation of fat into glycogen, A., ii, 418.
- Boudeuward, Octave**, numerical laws of chemical equilibrium, A., ii, 199.
- Bougault, J.**, action of iodine on antipyrine, A., i, 311.
- iodoantipyrine, A., i, 312.
- compounds of iodoantipyrine with mercuric salts, A., i, 361.
- oxidation of anethole and analogues (*isosafole*, *isocapiole*, etc.) containing propenyl side chains, A., i, 495.
- methoxyhydratropic acid obtained by oxidising anethole: identity of phloretic and hydro-*p*-coumaric acids, A., i, 495.
- synthesis of *p*-methoxyhydratropic acid, A., i, 548.
- action of iodine and mercuric oxide on styrene and safole, A., i, 641.
- Bouma, Jacob**, urinary indican, A., ii, 700.
- Bourest, Paul**, absorption of iodine by plants, A., ii, 100.
- water from Jouhe, near Dôle (Jura), A., ii, 355.
- metabolism of iodine, A., ii, 670.
- Bourest, Paul**. See also **Albert Charrin** and **Eugene Gley**.
- Bourgeois, Edouard**, preparation of aromatic thiols, A., i, 163.
- constitution of metallic salipyrines (metallic antipyrine-salicylates), A., i, 193.
- Bourquelot, Émile [Elie]**, and **Henri Hérissay**, seminaase, a new enzyme, A., i, 320.
- preparation of gentiopicrin, the glucoside of fresh gentian root, A., i, 511.
- germination of the carob bean (*Ceratonia Siliqua*); production of mannose by a soluble ferment, A., ii, 35.
- soluble ferments produced during the germination of seeds with horny albumen, A., ii, 233.
- carbohydrates in the reserve material of lucerne and fenugreek seeds, A., ii, 301.
- Bourquelot, Émile**, and **J. Laurent**, composition of the albumens of the St. Ignatius bean and *nux vomica*, A., ii, 498.
- nature of the reserve carbohydrates in the St. Ignatius bean and *nux vomica*, A., ii, 611.
- Bouveault, Louis**, α -dimethylisocrotonic (2-dimethyl-3-butinoic) acid, A., i, 131.
- synthesis of cyclopentane derivatives by means of ethyl adipate, A., i, 171.
- constitution of camphor, A., i, 182.
- complete synthesis of the phorone derived from camphoric acid, A., i, 207.

- Bouveault, Louis**, rhodinol and citronellol, A., i, 452.
- transformation of rhodinol into menthone, A., i, 452.
- ethyloxalic anhydride, A., i, 474.
- synthesis of higher homologues of ethyl acetoacetate and acetylacetone, A., i, 474.
- action of fuming nitric acid on camphene, A., i, 508.
- Bowtell, N. E.**, and **William Henry Perkin, jun.**, action of alcoholic potash on ethyl bromoglutarate P., 1899, 241.
- Brackel, (Freiherr) von**, transformation of hyponitrous acid into hydrazine, A., ii, 594.
- Brady, Friedrich**. See **Eugen Bamberger**.
- Bräunlich, F.** See **Alfred Werner**.
- Bräutigam, W.**, solanthic acid, A., i, 177.
- formation of vanillin in potato parings, and its detection, A., ii, 427.
- Brahm, Carl**, physiological action of quinosol [o-hydroxyquinolinesulphonic acid]: formation of conjugated glycuronic acids, A., ii, 95.
- Brakes, Jas.**, estimation of titanic acid in iron ore, A., ii, 248.
- Bran, Fr.** See **Fritz Haber**.
- Brandt, K.**, composition of plankton, A., ii, 609.
- Braren, Wilhelm**, and **Eduard Buchner**, ψ -phenylacetic acid, A., i, 292.
- Brasseur, J.** See **N. Blattner**.
- Braun, Julius von**, action of cyanogen bromide on tertiary amines, A., i, 430, 641, 687.
- preparation of phenylated guanidines from diphenylcyanamide, A., i, 642.
- convenient method for the preparation of aromatic thiocarbamides, A., i, 644.
- Braun, Julius von**, and **Fritz Stechele**, allylacetone, A., i, 429.
- Braun, Leonhard**, absorption of nitrogen and hydrogen by aqueous solutions of dissociating substances, A., ii, 529.
- Bréal, Émile**, absorption of water and dissolved substances by the stems of plants, A., ii, 35.
- accumulation of asparagine in leguminous plants, cultivated with insufficient light, A., ii, 301.
- Breasley, Harry**, direct combustion of metallic alloys, A., ii, 440.
- Breasley Harry**. See also **Fred Ibbotson**.
- Bredig, Georg**, preparation of colloidal metallic solutions by the disintegrating action of an electric discharge, A., ii, 213.
- Bredig, Georg**, colloidal cadmium, A., ii, 278.
- Bredig, Georg**, and **Alfred Coehn**, colloidal solutions, A., ii, 269.
- Bredig, Georg**, and **R. Müller von Berneck**, inorganic ferments. I. Catalytic action of platinum, and the chemical dynamics of hydrogen peroxide, A., ii, 218.
- Bredt, Julius**, and **H. Hof**, chlorylphthalimide and bromylphthalimide and their conversion into isatoic anhydride and acetylanthranil, A., i, 229.
- Bredt, Julius**, and **Wilhelm Jagelki**, camphenilaldehyde and camphenilanic acid, A., i, 134.
- Bredt, Julius**, and **J. B. C. Kerahaw**, action of nitric acid on acids of the fatty series which contain the isopropyl group, A., i, 136.
- Bregowsky, Ivan M.** See **Allen P. Ford**.
- Bremer, Hermann**, testing margarine and butter for sesamé oil, A., ii, 325.
- Breuksleveen, M. van**, crystalline compounds of succinimide and the phenols, A., i, 343.
- Breuksleveen, M. van**, and **A. ter Horst**, iron carbonyls and their importance in the industrial application of water gas, A., ii, 349.
- Breusing, Eduard**, manganocalcite and angolite, A., ii, 551.
- Breustedt, G.**, isolation of glycogen from horseflesh and preserved meats, A., ii, 321.
- Brévans, J. de**, detection of "saccharin" [o-benzoicacidulphinate] in articles of food, A., ii, 635.
- Brewer, C. E.** See **William Ridgely Orndorff**.
- Brickner, Wacław**. See **Georg Wagner**.
- Bridge, John L.**, and **William Conger Morgan**, ethers of isonitrosoguaiacol in their relation to the space isomerism of nitrogen, A., i, 158.
- Brieger, Ludwig**, arrow poison of Wakamba (German E. Africa), A., i, 243.
- cause of Ehrlich's diazo-reaction [in urine], A., i, 316.
- Briggs, C. H.** See **P. L. Sherman**.
- Briggs, John F.** See **Charles Frederick Cross**.
- Brightelli, Celso**, experiments on meadows, A., ii, 303.
- composition of *Apios tuberosa*, A., ii, 498.
- Britton, W. E.** See **Eduard H. Jenkins**, and **Samuel William Johnson**.
- Brochet, André**, electrolysis of potassium chlorate, A., ii, 205.

- Brochet, André**, electrolytic formation of potassium chlorate, A., ii, 276.
 — impossibility of the direct formation of potassium chlorate by electrolysis, A., ii, 541.
 — electrolysis of concentrated hypochlorite solutions, A., ii, 594.
 — Oettel's gasometric method, A., ii, 706.
 — accessory reactions in electrolysis, A., ii, 706.
- Broleher, J.** See **Karl Auwers**.
- Brown, Alexander Crum**, Nernst's osmotic experiment and a definition of osmotic pressure, A., ii, 194.
- Brown, Alexander Crum**, and **Herbert William Bolam**, electrolysis of ethyl potassium diethoxysuccinate, A., i, 201.
- Brown, Ernest W.** See **Lafayette B. Mendel**.
- Brown, Thomas, jun.**, estimation of antimony in ores, A., ii, 51.
- Browne, C. A., jun.**, chemistry of butter-fat; chemical composition of butter-fat, A., ii, 55.
 — rancidity in butter-fat, A., ii, 115.
- Browning, Kendall Colin**, hydroferrocyanic acid, T., 1233; P., 1900, 172.
- Browning, Kendall Colin**. See also **Richard Haliburton Adie**.
- Browning, Philip Embury**, estimation of thallium as the acid and normal sulphates, A., ii, 247.
- Browning, Philip Embury**, [with **William D. Cutler**, **G. A. Hanford**, **Leo A. Lynch**, and **F. J. Mall**], titrimetric estimation of cerium, A., ii, 170.
- Browning, Philip Embury**, and **John B. Hartwell**, qualitative separation of nickel from cobalt by the action of ammonium hydroxide on the ferri-cyanides, A., ii, 765.
- Browning, Philip Embury**, and **George P. Hutchins**, estimation of thallium as chromate, A., ii, 172.
- Brüggemann, H.** See **Ernst Otto Beckmann**.
- Brühl, Ernst**. See **Carl Friedheim**.
- Brühl, Julius Wilhelm**, [nitrosoalkylurethanes], A., i, 210.
 — tautomeric changes in solution, A., i, 497.
 — function of the medium in chemical changes, A., ii, 11.
 — hydrogen peroxide, A., ii, 535.
- Brüning, Ed.** See **Alexander Tschireh**.
- Brunek, Otto**, estimation of ozone, A., ii, 572.
- Bruner, Ludwik**, hydrolysis of salt solutions, A., ii, 268.
- Bruner, Ludwik**, chemical dynamics: dynamical observations on the bromination of benzene, A., ii, 647.
- Bruner, Ludwik**, and **Stanislaw Tollocsko**, velocity of the formation of esters from benzoyl chloride and aliphatic alcohols, A., ii, 648.
- Bruni, Giuseppe**, solid solutions and isomorphous mixtures, A., ii, 196.
 — reciprocal solubility of liquids, A., ii, 196.
 — recognition of racemic compounds, A., ii, 269.
 — physiological action of formaldehyde, A., ii, 359.
- Bruni, Giuseppe**, and **P. Berti**, nitrogen peroxide as a solvent, A., ii, 591.
 — cryoscopic behaviour of nitro-derivatives in formic acid, I., A., ii, 591.
 — behaviour of nitro-derivatives in formic acid solution, II., A., ii, 592.
- Bruni, Giuseppe**, and **F. Gorni**, physical equilibrium in mixtures of isomorphous substances, A., ii, 197.
 — solid solutions and isomorphous mixtures of saturated and non-saturated open-chain compounds, III., A., ii, 714.
- Bruni, Giuseppe**, and **N. Pappadà**, nature and properties of colloidal solutions, A., ii, 591.
- Brunner, Karl**, synthesis of indoline bases, A., i, 360.
- Brunnmayr, Heinrich**, preparation of dimethyl-1:2:3:5-phentetrol, A., i, 291.
- Bruno, G. G.**, the bile as a digestive juice, A., ii, 553.
- Brusoff, S.**, velocity of formation of olefines, A., i, 322.
- Brutskus, B. K.**, nutritive value of asparagine, A., ii, 237.
- Braylants, Gustave**, and **H. Druyts**, estimation of starch in yeast, A., ii, 113.
- Bruyn, B. R. de**, equilibrium in systems containing an alkali salt, water, and alcohol, A., ii, 266.
- Bruyn, B. R. de**. See also **Arnold Frederik Holleman**.
- Bruyn, Cornelis Adriaan Lobry de**, rate of substitution of nitro-groups by an alkoxyl group, A., i, 146.
 — condition of substances insoluble in water formed in gelatin, A., ii, 136, 717.
- Bruyn, Cornelis Adriaan Lobry de**, and **William Alberda van Ekenstein**, *d*-sorbitose and *l*-sorbitose (ψ -tagatose) and their configurations, A., i, 208, 332.

- Bruyn, Cornelis Adriaan Lobry de**, and *H. C. Bijl*, isodialdane, A., i, 205.
- Bruyn, Cornelis A. Lobry de**. See also *William Alberda van Ekenstein*.
- Bruyning, F. F., jun.**, and *J. van Haarst*, hydrocyanic acid in *Vicia* seeds, A., ii, 160.
- Bryant, Edward G.**, action of metallic magnesium on water, A., ii, 277.
- Bubák, Fr.**, mites in beet-root excrecences, A., ii, 501.
- Buchanan, John Young**, steam and brines, A., ii, 710.
- Buchböck, Gustav**, influence of the medium on the velocity of reaction, A., ii, 590.
- Bucher, John E.**, action of ethyl iodide on diethyl tartrate and sodium ethoxide, A., i, 203.
- Buchner, Eduard**. See *Robert Albert and Wilhelm Braren*.
- Buck, D. M.** See *Charles F. Mabery*.
- Buckow, Walter**. See *Robert Pschorr*.
- Buell, W. H.** See *Henry Lord Wheeler*.
- Bülow, Carl**, inactive *b-p*-nitraniline-azobenzoylacetone [*p*-nitrobenzene-azobenzoylacetone], A., i, 65.
- aliphatic aromatic azo- and tetrazo-derivatives of *p*-phenylenediamine, A., i, 261.
- difference of basicity of the two amino-groups of substituted diamines. I. *m*-Tolylenediamine, A., i, 690.
- Bülow, Carl**, and *Alfred Schlesinger*, preparation of isopyrazole derivatives from diethyl benzeneazodiacetylsuccinate, A., i, 56.
- Bülow, Karl**, estimation of oxalic acid in acid beet leaves, A., ii, 322.
- estimation of absorbable proteids in foods, A., ii, 459.
- Buisson, H.**, modification of metallic surfaces under the influence of light, A., ii, 519.
- Bull, Henrik**, estimation of unsaturated fatty acids in fish oils, A., ii, 250.
- analysis of fish oils, A., ii, 325.
- Bullnheimer, Friedrich**, and *E. Seitz*, alkali copper tartrates and Fehling's solution, II., A., i, 330.
- Bunge, Gustav von**, composition of the cartilage of the shark, A., ii, 29.
- sodium chloride in cartilage, A., ii, 92.
- Bunsen, Robert Wilhelm**, memorial lecture on (Roscoe), T., 513; P., 1900, 84.
- Burgess, Herbert E.**, new colour reaction for citral and certain other aromatic compounds, A., ii, 774.
- Burgess, Herbert E.** See also *Alfred Chaston Chapman*.
- Burian, Richard**, and *Heinrich Schur*, rôle of purine substances in human metabolism, A., ii, 489.
- Burrows, Harry**. See *Karl Auwers*.
- Busch, Max**, action of hydrazine on thiocarbamide, A., i, 27.
- Busch, Max**, and *Paul Bauer*, products of the action of hydrazine on thio-carbamides, A., i, 414.
- Busch, Max** [and *Ludwig Hartmann*], triazines from *o*-aminoazo-compounds, A., i, 59.
- Busch, Max**, and *Carl Heinrichs*, conversion of tetrazine into triazole derivatives, A., i, 314.
- Busch, Max**, and *Edmund Lingenbrink*, hydrazones of dithiocarbonates, A., i, 66.
- action of methyl iodide on dithiodiazolone disulphides; decomposition of thiodiazolones, A., i, 413.
- Busch, Max**, and *Edmund Lingenbrink*, [and in part *H. Holzmänn*], hydrazones of dithiocarbonates, A., i, 411.
- Busch, Max**, and *Bruno Weiss*, as-dibenzylhydrazines, A., i, 699.
- Buss, Karl H. E. G.**, [mineral analyses], A., ii, 217.
- Butkewitsch, Wl.**, occurrence and action of proteolytic ferments in germinated seeds, A., ii, 744.
- Buttenberg, Paul**. See *Rudolf Abel*.
- Butareanu, Vasile C.**, mineral analyses, A., ii, 149.
- constitution and classification of silicates, A., ii, 285.
- Byers, H. G.** See *Harmon Northrup Morse*.

C.

- Cajola, A.**, and *A. Cappellini*, hydrolysis in organic solvents, A., ii, 394.
- Calhane, D. F.**, and *P. M. Wheeler*, constitution of *a*-dibromodinitrobenzene, A., i, 146.
- Callsen, Jürgen**, alkaloids of the seeds of *Lupinus angustifolius* and of *L. perennis*, var. *polyphyllus*, A., i, 186.
- Calvert, Harry Thornton**, dielectric constant of hydrogen peroxide, A., ii, 331.
- Calzolari, F.** See *Felice Garelli*.
- Camerer, William**, and *Friedrich Söldner*, metabolism in children, A., ii, 222.
- Camerer, William, jun.**, and *Friedrich Söldner*, chemical composition of newborn children, A., ii, 290.
- Cameron, Frank Kenneth**, estimation of alkali carbonates in presence of alkali hydrogen carbonates, A., ii, 575.
- Cameron, Frank Kenneth**. See also *J. A. Emery*, and *William H. Krag*.

- Cambridge, P. J.**, and **Archibald Edward Garrod**, excretion of diamines in cystinuria, A., ii, 229.
- Camp, J. M.**, estimation of phosphorus in coke and coal, A., ii, 756.
- estimation of phosphorus in ores, pig-iron, and steel containing arsenic, A., ii, 757.
- estimation of alumina as phosphate in ore and blast-furnace cinder, A., ii, 763.
- Campbell, Edward D.**, thermochemistry of steel and iron, A., ii, 407.
- preparation of potassium xanthate for nickel estimations, A., ii, 577.
- Campbell, Edward D.** See also **William H. Hess**.
- Campbell, George F.** See **Thomas Burr Osborne**.
- Campbell, J. R.**, manuring of clover hay, A., ii, 429.
- use of nitragin and alinit for the growth of beans and oats respectively, A., ii, 433.
- Campetti, A.**, difference of potential between a solid salt and its solution, A., ii, 704.
- Camps, Rudolf**, syntheses of 2- and 4-hydroxyquinolines, A., i, 115, 310.
- Camus, L.**, and **Eugène Gley**, action of the liquid of the external prostate on the liquid of the *vesiculæ seminales*, A., ii, 673.
- properties of the secretion of the internal prostate of the hedgehog, A., ii, 674.
- Candussio, G.**, a new reagent for phenolic compounds, A., ii, 513.
- Cantacuzène, J.**, hæmolytic serum and red corpuscles, A., ii, 741.
- Cappelli, I.** See **Filippo Bottassi**.
- Cappellini, A.** See **A. Cajola**.
- Carcano, Luigi**, Ehrlich's diazo-reaction for the recognition of some recently introduced morphine derivatives, A., ii, 776.
- Carnot, Adolphe**, analyses of French mineral waters, A., ii, 552.
- new methods of mineral analysis, A., ii, 572.
- Carnot, Adolphe**, and **E. Goutal**, chemical constitution of steels; influence of tempering on the state of combination of elements other than carbon, A., ii, 545.
- Carpenter, F. B.**, estimation of pyrrhotite in pyrites ore, A., ii, 763.
- Carrara, Giacomo**, and **G. B. Vespignani**, energy of some metallic hydroxides deduced from the hydrolysis of their salts, A., ii, 647.
- Carta-Satta, C.** See **Gaetano Minunni**.
- Carter, W.**, and **William Trevor Lawrence**, the hydroxyphenoxy- and phenylenedioxy-acetic acids, T., 1222; P., 1900, 152.
- Carveth, Hector R.** *p*-anisaldoximes, A., i, 34.
- Casali, Adolfo**, Wagner's new reagent for estimating soluble phosphoric acid in basic slag, A., ii, 311.
- street-dust as manure, A., ii, 754.
- Caspari, Wilhelm**, the source of milk fat, A., ii, 153.
- Caspari, William Augustus**, electrolytic gas development, A., ii, 7.
- Castendyck, C.** See **Carl Friedheim**.
- Cathelineau, and Jean [Louis] Hausser**, empyreumatic oil of juniper, A., i, 510.
- Caubet, F.**, liquefaction of gaseous mixtures, A., ii, 191, 646.
- liquefaction of gaseous mixtures of carbon dioxide and sulphur dioxide, A., ii, 390.
- Cause, Henri [Eugène]**, [cystine in impure well waters in the neighbourhood of Lyons], A., ii, 457.
- detection and estimation of cystine, and its variation in amount in contaminated water, A., ii, 458.
- presence of tyrosine in contaminated well waters, A., ii, 458.
- Cavalier, Jacques**, phosphoric esters, A., i, 75.
- Cavalier, Jacques**, and **Eugène Prost**, some phosphoric esters, A., i, 579.
- Cavanaugh.** See **Stone**.
- Cavassi, Alfred**, calorimetric examination of pyrites and marcasite, A., ii, 598.
- Caven, Robert Martin**, reaction of magnesium, zinc, and iron with solutions of cupric sulphate, P., 1899, 232; A., ii, 344.
- Caseneuve, Paul**, synthesis of parabanic acid, A., i, 144.
- metallic compounds of diphenylcarbazone, A., i, 465.
- cuprous and mercurous derivatives of diphenylcarbazone, A., i, 465.
- diphenylcarbazide as a sensitive reagent for metals, A., ii, 627.
- Caseneuve, Paul**, and **Moreau**, preparation of carbazides: action of phenol carbonates, A., i, 196.
- Caseneuve, Paul**, and **Paul Sisley**, tinctorial properties of diphenylcarbazone, A., i, 701.
- Čečelsky, Jaroslav**, a condensation product of trimethylphloroglucinol, A., i, 225.
- Cedivoda, Franz.** See **Hugo Dits**.
- Censi, J.**, action of methyl chloroacetate on tertiary bases, A., i, 363.

- Chain, M.** See *Wilhelm Marekwald*.
- Chambers, Victor J., and Joseph C. W. Fraser,** minimum in the molecular lowering of the freezing point of water, produced by certain acids and salts, A., ii, 526.
- Chambers, Victor J.** See also *Harry Clary Jones*.
- Chapelle, Ph.,** new method for the gravimetric estimation of sugars, A., ii, 112.
- estimation of reducing sugar by means of a centrifuge, A., ii, 629.
- Chapman, Alfred Chaston,** distinguishing between hops and quassia, A., ii, 380.
- Chapman, Alfred Chaston, and Herbert E. Burgess,** improved absorption apparatus for use in the analysis of essential oils, A., ii, 693.
- Chapman, Edgar Marsh.** See *Arthur Lapworth*.
- Charabot, Eugène,** genesis of terpenes in lavender, A., i, 241.
- genesis of compounds of the menthol series in plants, A., i, 303.
- progressive development of essence of bergamot, A., ii, 101.
- metamorphoses and migrations of compounds of the linalool group in plants, A., ii, 361.
- influence of active vegetable growth on the formation of thujone and thujol, A., ii, 362.
- Chardin, D. A.,** formation of safranines, A., i, 610.
- Charitschkoff, K. W.,** heptane contained in Grosny naphtha, A., i, 74.
- composition of naphtha from Grosny, A., ii, 147.
- Charon, Ernest, and C. Paix-Séailles,** glycol moniodohydrin, A., i, 423.
- a product of the decomposition of glycerol diiodohydrin, A., i, 472.
- Charrin, Albert,** toxicity of urine, A., ii, 559.
- Charrin, Albert, and Paul Boureot,** variations in the iodine of the thyroid of new-born children under various pathological conditions, A., ii, 419.
- Charrin, Albert, and A. Guillemonat,** hepatic glycogen during pregnancy, A., ii, 292.
- influence of extract of ovaries on the changes produced in nutrition during pregnancy, A., ii, 554.
- influence of experimental modifications on the consumption of sugar, A., ii, 606.
- Charrin, Albert, and Levadite,** defence of the organism against the toxic properties of glandular secretions, A., ii, 224.
- Chattaway, Frederick Daniel,** composition of nitrogen iodide, A., ii, 594.
- Chattaway, Frederick Daniel, and Kennedy Joseph Previle Orton,** substituted nitrogen chlorides and their relation to the substitution of halogen in anilides and anilines. II. Trichlorophenyl acyl nitrogen chlorides, T., 134; P., 1899, 232.
- substituted nitrogen chlorides and bromides derived from *o*- and *p*-acetotoluidide, T., 789; P., 1900, 102.
- ortho-substituted nitrogen chlorides and bromides and the entrance of halogen into the ortho-position in the transformation of nitrogen chlorides, T., 797; P., 1900, 112; discussion, P., 112.
- substituted nitrogen bromides, and their relationship to bromo-substituted anilides and anilines, A., i, 152.
- anilines and anilides, A., i, 643.
- preparation and properties of so-called nitrogen iodide, A., ii, 399.
- action of light on nitrogen iodide, A., ii, 594.
- action of alkaline hydroxides, of water, and of hydrogen peroxide on nitrogen iodide, A., ii, 722.
- formation and constitution of nitrogen iodide, A., ii, 722.
- Chattaway, F. D., K. J. P. Orton, and W. H. Hurtle,** nitrogen chlorides derivable from *m*-chloroacetanilide and their transformation, T., 800; P., 1900, 125.
- anilides, A., i, 151.
- Chattaway, Frederick Daniel, and Henry Potter Stevens,** action of reducing agents on nitrogen iodide, A., ii, 399.
- action of acids on nitrogen iodide, A., ii, 722.
- Chavastelon, R.,** action of acetylene on cuprous chloride dissolved in potassium chloride solution, A., i, 470.
- crystalline compounds of acetylene with cuprous and potassium chlorides, A., i, 470.
- mode of formation of the compounds $C_2H_2(Cu_2Cl_2)_2$, KCl and $C_2H_2[(Cu_2Cl_2)_2KCl]_2$, A., i, 470.
- separation of the rare earths, A., ii, 346.
- Chéneau, Octave,** scheme for the analysis of rubber wares, A., ii, 639.
- Chevalet, F.,** estimation of carbon dioxide in ammoniacal gas liquor, A., ii, 170.
- Chiaraviglio, D.** See *Jacobus H. van't Hoff*.
- Chikashige, Masumi.** See *Mitsuru Kuhara*.

- Chilesotti, Alberto**, refraction of hydrocarbons with condensed benzene nuclei, A., i, 339.
- Christensen, Joseph C.**, boiling-points of mixtures of chloral and water, A., i, 626.
- Christensen, Odin T.**, manganese compounds. I. Ammonium permanganate, A., ii, 596.
- Christmas, J. de**, the gonococcus and its toxin, A., ii, 742.
- Claessen, C.**, dopplerite, A., ii, 20.
- Claisen, Ludwig**, and **E. Haase**, acetylation of ethyl acetoacetate, A., i, 373.
- Clark, John**, analysis of copper, A., ii, 369.
- separation of bismuth from lead, A., ii, 371.
- Clark, Mary E.** See **J. H. Kastle**.
- Clarke, Charles H.**, and **Edgar Francis Smith**, electrolytic oxidation of succinic acid, A., i, 77.
- Clarke, Frank Wigglesworth**, report of the [American] Committee on atomic weights, A., ii, 339.
- Clarke, Frank Wigglesworth**, and **George Steiger**, constitution of pectolite, pyrophyllite, hemimorphite, and analcite, A., ii, 24.
- action of ammonium chloride on analcite and leucite, A., ii, 219.
- action of ammonium chloride on natrolite, scolecite, prehnite, and pectolite, A., ii, 414.
- Clarke, Thomas**, 8-heptylamine, A., i, 83.
- Claude, Georges**, extraction of oxygen from air by dissolution at a low temperature, A., ii, 649.
- Claude, H.**, and **W. Balthazard**, cryoscopy of urine in diagnosis and prognosis, A., ii, 154.
- Clauser, Robert**, new method of indigo assay, A., ii, 180.
- estimation of cresols by determining their capability of forming bromo-substitution derivatives, A., ii, 319.
- Clayton, Edwy G.**, analyses of ginger, A., ii, 60.
- Cleghorn, Allen**, physiological action of extracts of sympathetic ganglia, A., ii, 557.
- Clemen, J.** See **Reinhold von Walther**.
- Clemens, P.**, diazo-reactions of urine, A., ii, 227.
- Clennell, J. E.**, estimation of copper in cyanide solutions, A., ii, 370.
- Clere, A.** See **Ch. Achard**.
- Clinton**. See **Stone**.
- Cloëtta, Max**, origin of the proteids in albuminaria, A., ii, 155.
- Clowes, G. H. A.**, and **Bernhard Tollens**, formaldehyde or methylene derivatives of acids belonging to the sugar group, A., i, 205.
- detection and estimation of formaldehyde in the free state and in its compounds, A., ii, 56.
- Clymer, William R.** See **Charles Frederic Mabery**.
- Cobleigh, W. M.** See **Frank W. Tra-phagen**.
- Cohn, Alfred**. See **Georg Bredig**.
- Coen, Edoardo**, bisphenylethylenetetra-hydropyronecarboxylic acid, A., i, 307.
- Cohen, Emil Wilhelm**, meteoric iron from Quesa, Spain, A., ii, 415.
- meteoric iron from Morradal, Norway, A., ii, 488.
- meteoric irons, A., ii, 644.
- meteoric irons from Griqualand East, S. Africa, A., ii, 736.
- meteoric iron from Bethany, Great Namaqualand, A., ii, 736.
- Cohen, Ernst**, a new kind of transition element, A., ii, 183.
- theory of the transition cell of the third kind, A., ii, 184.
- alleged identity of red and yellow mercuric oxides, I., II., A., ii, 184, 381.
- new method of determining transition temperatures, A., ii, 188.
- enantiotropy of tin, A., ii, 212, 408.
- thermodynamics of normal cells, A., ii, 520, 703.
- meta-stable character of the Weston cadmium element and its uselessness as a standard cell, A., ii, 702.
- studies on inversion, I., A., ii, 716.
- Cohen, Ernst**, and **C. van Rijk**, enantiotropy of tin, A., ii, 83, 212.
- Cohen, Ernst**, and **H. Raken**, solubility of calcium carbonate in sea-water, A., ii, 725.
- Cohn, Georg**, phenacetin, A., i, 29.
- salicylanilinoacetic acid (o-carboxy-phenylglycolic acid monanilide) and its derivatives, A., i, 93.
- leucomethylene-blue, A., i, 455.
- salol, A., i, 548.
- tetramethyldiaminodiphenylmethane and similar substances, A., i, 608.
- Cohn, Paul**, action of menthol on ethyl acetoacetate, A., i, 350.
- Cohn, Paul**, and **Armin Fischer**, 4-chloro-m-phenylenediamine, A., i, 458.
- preparation of diphenylmethane derivatives from p- and o-aminobenzyl-aniline and their homologues, A., i, 690.
- Cohn, Paul**, and **Siegfried Tauss**, menthyl acetoacetate, A., i, 350.

- Cohn, Robert.** See **Arthur Rosenheim.**
- Cohn, Rudolf,** formation of bases from albumin, A., i, 466.
- Cohnheim, Otto,** absorption in the small intestine, A., ii, 289.
- Cohnheim, Otto, and H. Krieger,** estimation of combined hydrochloric acid in gastric juice, A., ii, 508.
- behaviour of proteids to alkaloid reagents, and a method of estimating combined hydrochloric acid, A., ii, 778.
- Cojazzi, F.,** energy of some hydroxy-sulphonic acids, A., i, 327.
- Coles.** See **Cowper-Coles.**
- Collie, John Norman,** dehydracetic acid, T., 971; P., 1900, 147.
- Collie, John Norman, and Bertram D. Steele,** dimethyldiacetylacetone, tetramethylpyrone, and orcinol derivatives from diacetylacetone, T., 961; P., 1900, 146.
- periodides of substituted oxonium derivatives, T., 1114; P., 1900, 164.
- Collins, Edward.** See **Theodore William Richards.**
- Colman, Harold Govett, and James F. Smith,** estimation of naphthalene in coal gas, A., ii, 372.
- Colman, James.** See **Siegmund Gabriel.**
- Colomba, Luigi,** anhydrite and gypsum deposits at Oulx, Piedmont, A., ii, 216.
- Colson, Albert,** reciprocal displacement of metals, A., ii, 140.
- volumetric estimation of hydrogen; diffusion of a solid into a gas, A., ii, 241.
- Con.** See **Carl Adam Bischoff.**
- Condelli, S.** See **C. Ulpiani.**
- Coninck.** See **Oechsmar de Coninck.**
- Conn, Wallace T.** See **Arthur Michael.**
- Conrad, H. E.** See **Alfred Werner.**
- Conrad, Max,** synthesis of *aa*-dimethylglutaconic acid, A., i, 475.
- Conrady, A.,** detection of salicylic acid in presence of citric acid, A., ii, 769.
- Conroy, James Terence,** testing of acetone, A., ii, 374.
- Cook, C. G.,** double halogen salts of tin with aliphatic amines and with tetramethylammonium, A., i, 142.
- Coolidge, W. D.,** dielectrical researches and electrical waves, A., ii, 3.
- Cooper, Herman C.,** stereoisomerides and racemic compounds, A., ii, 269.
- Copony, H.** See **Zdenko Hanns Skraup.**
- Coppet, Louis Casimir de,** freezing point of mixtures of acetic acid and water, A., ii, 65.
- Coppet, Louis Casimir de,** temperature of maximum density of solutions of ammonium chloride, lithium bromide, and lithium iodide, A., ii, 529.
- Cordier, V. von,** action of chlorine on metallic silver in the light and in the dark, A., ii, 343, 723.
- Corio, F.,** crystallographic characters of some isomorphous potassium salts, A., ii, 593.
- Corletta, Cyril,** excretion in the small intestine, A., ii, 673.
- Cormack, William,** estimation of furfuraldehyde, T., 990; P., 1900, 156.
- Cormack, William.** See also **James Walker.**
- Corney, B. G., E. David, and Frederick Bickell Guthrie,** edible earth from Fiji, A., ii, 569.
- Cornu, Charles,** presence of an oxidising enzyme in the vine, A., ii, 102.
- Coronedi, Giusto.** See **Pietro Albertoni.**
- Cotton, S.,** oxidation of urine; phenols and indican, A., ii, 293.
- Counclor, Constantin,** estimation of cellulose, A., ii, 630.
- Coupin, Henri,** action of anæsthetic vapours on the vitality of dry and moist seeds, A., ii, 35.
- poisonous properties of sodium chloride and sea water towards plants, A., ii, 236.
- toxic action of compounds of the alkaline earth metals towards the higher plants, A., ii, 363.
- the crystalline stalk of accephalous molluscs, A., ii, 420.
- Couquet, H. C.** See **M. E. Possi-Escot.**
- Cousin, H.,** preparation of tetrachloro- and tetrabromo-orthoquinones from the corresponding tetrahaloid guaiacols and veratroles, A., i, 179.
- action of nitric acid on trichloroguaiacol, A., i, 487.
- Cowper-Coles, Sherard,** electro-deposition of chromium, A., ii, 408.
- Crafts, James Mason,** Friedel Memorial Lecture, T., 993.
- Crane, F. D.,** tellurium, A., ii, 473.
- Crépieux, Pierre.** See **Frédéric Reverdin.**
- Cribb, Cecil H.,** influence of temperature and concentration on the saline constituents of boiler water, A., ii, 542.
- Crispo, D.,** rapid process for the estimation of starch; estimation of starch in yeast, A., ii, 176.
- Crivelli, C., and Stanislaus von Kostanecki,** *β*-methyl-2-hydroxychromone, A., i, 668.
- Crofts, James Murray.** See **Robert Selby Morrell.**

- Cronquist, Werner**, preliminary tests for clays, A., ii, 171.
- Crookes, Sir William**, radio-activity of uranium, A., ii, 586.
- Cross, Charles Frederick, Edward John Bevan, and John F. Briggs**, interaction of furfuraldehyde and Caro's reagent, A., i, 682.
- Cross, Charles Frederick, Edward John Bevan, and Thv. Heiberg**, action of hydrogen peroxide on unsaturated hydrocarbons, A., i, 534.
- Cross, Charles Frederick, Edward John Bevan, and J. S. Remington**, furfuroids of plant tissues, A., ii, 611.
- Cross, Charles Frederick**. See also A. Luck.
- Crossley, Arthur William**, interaction of mesityl oxide and ethyl sodiomethylmalonate, P., 1900, 90.
- Crossley, Arthur William, and Henry Rondei Le Sueur**, determination of the constitution of fatty acids. Part II., T., 83; P., 1899, 225.
- Crotogino, F.**, oxidation potentials, A., ii, 642.
— [electrometric estimation of iodine], A., ii, 685.
- Crotogino, F.** See also *Friedrich Wilhelm Küster*.
- Cumenge, E.**, von-diestite, a new mineral, A., ii, 660.
- Cuniasse, L.**, colour reaction to distinguish the hydrochlorides of *m*- and *p*-phenylenediamines, A., ii, 57.
— action of strong aqueous soda on methyl acetate in the presence of methyl alcohol and acetone, A., ii, 175.
— analyses of marine Algae, A., ii, 680.
- Curie, P.**, action of the magnetic field on Becquerel rays; deflected and undeflected rays, A., ii, 126.
- Curie, P., and Sklodowska Curie**, new radio-active substance contained in pitchblende, A., ii, 82.
— chemical effects produced by Becquerel rays, A., ii, 125.
— electric charge of the deviable rays of radium, A., ii, 254.
- Curie, P., Sklodowska Curie, and Gustave Bémont**, an extremely radio-active substance contained in pitchblende, A., ii, 82.
- Curie, Sklodowska**, rays emitted by uranium and thorium compounds, A., ii, 81.
— atomic weight of the metal in radio-active barium chloride, A., ii, 83.
— penetration of undeflected Becquerel rays, A., ii, 126.
— atomic weight of radio-active barium, A., ii, 654.
- Curtel, Georges**, experiments on the physiological phenomena which accompany chlorosis in the vine, A., ii, 428.
- Curtiss, Richard Sydney**, action of nitrous acid on ethyl anilinomalonate, A., i, 482.
- Curtius, Theodor**, action of nitrous acid on benzylhydrazine, A., i, 698.
— reduction of benzylidenehydrazine to benzylhydrazine, A., i, 700.
- Curtius, Theodor, and August Darapsky**, azoimide, A., ii, 474.
- Curtius, Theodor** [and in part with E. Haager, E. Harding, A. Prope, and G. Sprenger], reduction of aromatic aldazines: synthesis of benzylhydrazine, A., i, 610.
- Curtius, Theodor, and A. Lublin**, nitrobenzylidenehydrazines, A., i, 700.
- Curtius, Theodor** [and in part with H. Melsbach], preparation of aromatic aldehydes from the corresponding acids by means of hydrazine, A., i, 701.
- Cushman, Allerton S.**, some isomeric halogen compounds of thallium and the constitution of double salts, A., ii, 725.
- Cushny, Arthur R.** See *George B. Wallace*.
- Cutler, William D.** See *Philip Embury Browning and William J. Gies*.
- Czajkowski, J., Stanislaus von Kostanecki, and Josef Tambor**, synthesis of 1:3:4'-trihydroxyflavone (apigenin), A., i, 504.
- Czapek, Friedrich**, chemistry of the cell membrane of mosses and liverworts, A., i, 556.
— root secretions, A., ii, 234.
- Czerny, Hans**, fenchone, A., i, 675.

D.

- D'Achiardi, Giovanni**, allophane from Italy, A., ii, 218.
— larderellite from the suffioni of Tuscany, A., ii, 600.
— phosphorescent dolomite from Elba, A., ii, 661.
- Daeco, S.** See *Karl Auwers*.
- Dafert, Franz W.**, valuation of basic slags, A., ii, 167.
- Dahms, Albert**, freezing point of mixtures of acetic acid and water, A., ii, 65.
- Dains, Frank Burnett**, action of certain acid reagents on substituted carbamides, A., i, 390.
- Dakin, H. D.**, estimation of zinc as phosphate, A., ii, 624.
- Dam, J. W. van**, action of potassium hypobromite on amides of hydroxybenzoic acids, A., i, 171.

- Dambergis, Anastasius K.**, mineral waters of Lutraki, Greece, A., ii, 90.
- Danneel, H.**, chemical equilibrium and electromotive force, A., ii, 464.
- chemical kinetics and free energy of the reaction, $2\text{HI} + 2\text{Ag} \rightleftharpoons 2\text{AgI} + \text{H}_2$, A., ii, 467.
- Danyss, Jean**, action of the tetanus toxin on nervous substances, A., ii, 156.
- Darapsky, August.** See *Theodor Curtius*.
- David, E.** See *B. G. Corney*.
- Davidson, C.**, estimation of nitric nitrogen by Schloesing's method, A., ii, 437.
- Davis, William Alfred**, etherification of derivatives of β -naphthol, T., 33; P., 1899, 210.
- Dawson, Harry Medforth**, and **John McCrae**, the nature of metal-ammonia compounds in aqueous solution. Part I., T., 1239; P., 1900, 172.
- Dawson, Harry Medforth**, and **P. Williams**, determination of transition temperatures, P., 1899, 210.
- stable hydrates of manganese chloride above 0° , A., ii, 210.
- electrolytic conductivity of saturated solutions, A., ii, 383.
- Dawson, Harry Medforth.** See also *Jacobus Henricus van't Hoff*.
- Dawson, Maria**, further observations on nitragin, and the nature and functions of the nodules of leguminous plants, A., ii, 610.
- Dawson, Percy M.**, infusion after severe hæmorrhage, A., ii, 291.
- hæmorrhage and transfusion in dogs, A., ii, 417.
- Dean, George**, atomic weight of nitrogen, T., 117; P., 1899, 213.
- Debierne, A.**, a new radio-active substance, A., ii, 20.
- actinium, a new radio-active element, A., ii, 350.
- artificial radio-active barium, A., ii, 586.
- Debus, Heinrich**, genesis of Dalton's atomic theory, A., ii, 136.
- Decker, Hermann**, ammonium compounds. V. Ammonium alcoholates, A., i, 522.
- some ammonium compounds. VI. Formula of cotarnine, A., i, 683.
- luminosity of 1-ethyl-2-quinolone, A., i, 688.
- some ammonium compounds. VII. Nitration of alkyl-quinoline salts, A., i, 689.
- Defesqs, Ed.**, tungsten diphosphide, A., ii, 350.
- Dehérain, Pierre Paul**, cultivation of wheat and oats at Grignon, A., ii, 303.
- experiments at Grignon, A., ii, 680.
- Dehérain, Pierre Paul**, and **Em. Demoussy**, cultivation of white lupins, A., ii, 238.
- cultivation of blue lupins, A., ii, 304.
- Dehérain, Pierre Paul**, and **C. Dupont**, composition of the gas confined in farm-yard manure, A., ii, 617.
- Deiter, Joseph.** See *Adolf Beythien*.
- Delacroix, Maurice**, synthesis of benzene by the action of zinc ethyl on acetophenone, A., i, 603.
- gradual synthesis of the benzene ring, A., i, 603.
- Delacroix, A. E.**, antimonic acid and antimonates, A., ii, 145.
- Delage, Marcel**, pyrogallolsulphonic acids, A., i, 595.
- Delange, Raymond**, eugenol, safrole, and propylcatechol, A., i, 289.
- Delange, Raymond.** See also *Charles Mouren*.
- Delépine, Marcel**, methylene sulphate or sulphuric methylal, A., i, 130.
- action of methylene sulphate on benzyl alcohol, A., i, 163.
- metallic derivatives of salicylhydramide, A., i, 177.
- reduction of tungsten trioxide by zinc; preparation of pure tungsten, A., ii, 548.
- Delépine, Marcel**, and **L. A. Hallopeau**, heat of oxidation of tungsten, A., ii, 8.
- Delépine, Marcel.** See also *Marcellin Berthelot*.
- Delezenne, C.**, antileucocytic serum and its action on the coagulation of the blood, A., ii, 423, 554.
- antihæpatic serum, A., ii, 675.
- Delluc, G.** See *Th. Roman*.
- Demarcay, Eugène [Anatole]**, spectrum of a radio-active substance [in barium chloride], A., ii, 83.
- spectrum of radium, A., ii, 83, 586.
- presence of vanadium, molybdenum, and chromium in plants, A., ii, 285.
- new method of fractionating some rare earths, A., ii, 347.
- samarium, A., ii, 404.
- unknown earths contained in crude samarium oxide, A., ii, 481.
- gadolinium, A., ii, 597.
- new spectra of the rare earths, A., ii, 556.
- Demoussy, Em.**, absorption of soluble salts by plants, A., ii, 161.
- [basic constituents of crops], A., ii, 570.

- Demoussy, Em.** See also *Pierre Paul Dehérain*.
- Denigès, Georges**, organo-mercuric compounds, A., i, 89.
- oxidation of citric and malic acids by potassium permanganate, A., i, 204.
- formation of crystalline manganese oxalate by the oxidation of citric acid with potassium permanganate, A., i, 274.
- colour reaction of tyrosine, A., ii, 378.
- Derby, I. H.** See *Charles Loring Jackson*.
- Deroide, E., and Oui**, source of error in testing for albumin in urine, A., ii, 123.
- Dérôme, Juvénal**, action of cyanogen chloride on ethyl acetonedicarboxylate, A., i, 426.
- Derrien, E.**, solubility of benzophenone, A., i, 299.
- Derrien, E.** See also *William Oechsner de Coninck*.
- Desborough, A. P. H.** See *William Richard Eaton Hodgkinson*.
- Desgrez, Alexandre.** See *Charles Bouchard*.
- Deuburg, John van, and Otis B. Wight**, physiological action of the poisonous secretion of the Gila Monster, A., ii, 677.
- Deussen, Ernst, W.** Indian sandalwood oil, A., ii, 579.
- Deventer, Charles Marius van**, estimation of nitrates, A., ii, 242.
- Dewey (Miss), S. L.** See *George T. Kemp*.
- Dickson, D., and L. Malpeaux**, nitragin, A., ii, 505.
- milk and artificial foods for fattening calves, A., ii, 566.
- Dickson, Edmund.** See *Philip Holland*.
- Didier, Gaston.** See *Albert Granger*.
- Dieckmann, Wilhelm**, nitroso-compounds derived from cyclic 2-ketocarboxylic esters (bisnitroso-2-carboxylic esters and α -oximinodicarboxylic acids), A., i, 297.
- behaviour of phenylcarbimide with ethyl acetoacetate, A., i, 482.
- condensations with ethyl acetoacetate and their reversal, A., i, 623.
- Dieckmann, Wilhelm, and A. Groeneveld**, nitroso-compounds from ethyl methyl-2-ketopentamethylenecarboxylate, obtained by the condensation of ethyl β -methyladipate, and their constitution, A., i, 297.
- Diepolder, Emil**, methyl-*o*-anisidine, methyl-*o*-aminophenol and their oxidation products (6-methylphenoxazine-2,3 quinone), A., i, 191.
- Diergart, Paul**, etymological researches on the names of the chemical elements, from which the international and national symbols are derived, with special reference to the German names, A., ii, 593.
- Dieseldorff, Arthur**, melonite from S. Australia, A., ii, 664.
- Dieterich, Karl**, examination of resins. X. Storax. XI. Anime, caranna, dammar, labdanum, mastic, sandarac, tacamahaca, and turpeth. XII. Ammoniacum, bdellium, galbanum, opoponax, and sagapenum, A., ii, 118.
- Dieterici, Konrad**, the critical state, A., ii, 67.
- Dietrich, Emil.** See *Robert Behrend*.
- Dietze, F.**, stannous chloride and Bettendorf's test for arsenic, A., ii, 244.
- Dilthey, Walther.** See *Otto Fischer*.
- Dinglinger, Paul**, derivatives of *p*-aminobenzophenone, A., i, 503.
- Ditte, Alfred**, crystallisation of gold, A., ii, 549.
- Ditthorn, Fritz.** See *Friedrich N. Schulz*.
- Ditz, Hugo**, bromination of phenols, A., i, 225.
- commercially pure oleic acid and purified oleic acid, A., ii, 632.
- Ditz, Hugo, and Franz Cedivoda**, action of bromine on phenol and cresols with reference to the analysis of mixtures of these compounds, A., ii, 54.
- Ditz, Hugo, and Heinrich Knöpfelmacher**, iodometric process for the analysis of a mixture of chlorate and hypochlorite, A., ii, 241.
- Ditz, Hugo.** See also *Eduard Donath*.
- Divers, Edvard**, the colour of alkali nitrites, P., 1900, 40.
- solubility of mixed potassium nitrite and nitrate, P., 1900, 40; discussion, P., 40.
- products of the action of sulphur dioxide on ammonia, P., 1900, 104; discussion, P., 105.
- Divers, Edvard, and Tanemasa Haga**, potassium nitritohydroximidosulphates, and the non-existence of dihydroxylamine derivatives, T., 432; P., 1900, 54.
- identification and constitution of Fremy's sulphazotised salts of potassium, T., 440; P., 1900, 55.
- the interaction between sulphites and nitrites, T. 673; P., 1900, 70.
- decomposition of hydroxy-amidosulphates by copper sulphate, T., 978; P., 1900, 147.

- Divers, Edward**, and **Masataka Ogawa**, ammonium amidosulphite, T., 327; P., 1900, 38.
- products of heating ammonium sulphites, thiosulphate and trithionate, T., 335; P., 1900, 39.
- ammonium imidosulphite, P., 1900, 113.
- Divine, R. E.**, process for the estimation of carbon dioxide in carbonates, A., ii, 686.
- estimation of free alkali in soaps, A., ii, 759.
- Dixon, Walter E.**, physiological action of Poehl's spermine, A., ii, 676.
- Djerdjian, G.** See **Eugen Bamberger**.
- Debbie, James Johnstone.** See **Walter Noel Hartley**.
- Dobbin, Leonard**, detection of sulphates in presence of thiosulphates, A., ii, 437.
- Dobroserdoff, D.**, trihydrated acid cadmium iodide, A., ii, 654.
- supposed decomposition of nickel sulphate by light, A., ii, 658.
- Dodd, F. Robertson.** See **Alfred Smeatham**.
- Deebner, Oscar [Gustav]**, glauconic acids, II., A., i, 313.
- glyoxylic acid, A., i, 473.
- synthesis of phthalidetricarboxylic and phthalidedicarboxylic acids; a new passage from the aliphatic to the aromatic series, A., i, 499.
- synthesis of sorbic acid, A., i, 536.
- Döhlér, E.**, estimation of chromium in iron and steel, A., ii, 110.
- estimation of molybdenum in iron, A., ii, 691.
- Döring, Theodor**, detection of minute quantities of gold in ores, A., ii, 371, 445.
- Dörner, Friedrich.** See **Friedrich Emich**.
- Doerstling, P.**, practical conclusions from [the results of] soil analyses, A., ii, 752.
- Doherty, William Michael**, manganese nodules from New South Wales, A., ii, 233.
- Dohrn, Mar.** See **Karl Auwers**.
- Dolzsalek, F.**, theory of lead accumulators, A., ii, 2.
- Dolzsalek, F.** See also **Walter Nernst**.
- Donaldson, Henry H.**, decrease of water in the central nervous system of the growing white rat, A., ii, 556.
- Donath, Eduard**, and **Hugo Ditz**, oxidation of organic compounds with alkaline potassium permanganate, A., i, 197.
- Donnan, Frederick George**, nature of soap emulsions, A., ii, 201.
- Donnan, Frederick George**, relative rates of effusion of argon, helium, and some other gases, A., ii, 390.
- Dony-Hénault, Octave**, electrolytic syntheses of organic substances, II. (Iodoform), A., i, 577.
- electro-synthesis of organic substances, A., ii, 644.
- Doolittle, R. E.**, and **William H. Hess**, cider vinegar; its solids and ash, A., ii, 450.
- Doolittle, R. E.** See also **William H. Hess**.
- Dootson, Frederick William**, condensation of methyl acetonedicarboxylate; constitution of orcinoltricarboxylic esters, T., 1196; P., 1900, 170.
- Dootson, Frederick William.** See also **William James Sell**.
- Dowgallo.** See **Carl Adam Bischoff**.
- Dowzard, Edwin**, viscosity of essential oils, A., i, 676.
- Dralle, Christopher**, composition of bottle glasses, A., ii, 482.
- Dröbglaff, A.**, synthesis of styryltrichloromethylcarbinol, and the action of 5 per cent. aqueous potassium hydroxide on it, A., i, 490.
- Dreyfus, Camille.** See **Fritz Fichter**.
- Dreyfus, W. E.** See **Albert Hilger**.
- Driessen-Marcou, W. P. H. van den, Cortez Lokri, A.**, ii, 102.
- maripa fat, A., ii, 773.
- Drossbach, G. Paul**, laboratory apparatus for roasting large quantities of material, A., ii, 270.
- Drugman, Julien**, and **William Ramsay**, specific gravities of the halogens at their boiling points, and of oxygen and nitrogen, T., 1228; P., 1900, 172.
- Druyts, H.** See **Gustave Bruylants**.
- Dshewachoff, A.** See **Alexander P. Sabanéeff**.
- Du Bois, H. E. J. G.**, and **Otto Liebknecht**, molecular susceptibility of the salts of the rare earths, A., ii, 127, 333.
- Ducháček, F.** See **Julius Stoklasa**.
- Duclaux, Emile**, physiology of yeast, A., ii, 678.
- Duden, Paul**, benzenesulphonamides of primary bases; the use of Hinsberg's reaction for determination of structure, A., i, 282.
- a case of chemical equilibrium suitable for demonstration, A., ii, 267.
- Duden, Paul**, and **Alfred E. Macintyre**, the vinylamine of the camphor group, A., i, 302.
- Duden, Paul, Alfred E. Macintyre**, [and in part **J. Robertson**], synthetical bases of the series of terpenes and camphors; camphenamine and β -isocamphor, A., i, 674.

Duden, Paul, and **W. Treff** [and in part with **D. Heynsius**], synthetical bases of the series of terpenes and camphors; pyrrole derivatives of the camphor group, A., i, 671.

Dudley, Charles B. See **William Albert Noyes**.

Dünneberger, E. See **C. Hartwich**.

Dufau, Emile, crystallised monocalcium aluminate, A., ii, 728.

Dufau, Emile. See also **Gustave Patein**.

Duff, W. A. See **J. Livingston R. Morgan**.

Dugan, Claude. See **Edgar Francis Smith**.

Dugas, E. See **A. Aignan**.

Duhem, Pierre, emission and absorption of water vapour by colloidal matter, A., ii, 338.

— permanent change and thermodynamics, A., ii, 524, 708.

Dumas, L., allotropic transformations of iron and nickel alloys, A., ii, 408.

Dumesnil, Ernest, detection of barium, calcium and strontium, and the action of ammonium chloride on strontium chromate, A., ii, 625.

Dumesnil, Ernest. See also **Antoine Villiers**.

Dunin-Sulgustowski. See **Carl Adam Bischoff**.

Dunlop, James Crauford. See **Diarmid Noël-Paton**.

Dunstan, Wyndham Rowland, and **Ernest Goulding**, action of alkalis on the nitro-compounds of the paraffin series. Part II. Reactions and constitution of methazonic acid and the mode of formation of isoxazoles, T., 1262; P., 1900, 174.

Dunstan, Wyndham Rowland, and **Harold M. Road**, contributions to our knowledge of the aconite alkaloids. Part XV. On japaconitine and the alkaloids of Japanese aconite, T., 45; P., 1899, 206; discussion, P., 207.

Duparo, Louis, and **F. Pearce**, granitoid rocks from Cape Marsa, A., ii, 219.

— plagioliparites of Cape Marsa, Algeria, A., ii, 220.

Dupont, C. See **Pierre Paul Dohérain**.

Durieu, estimation of acetic acid in vinegar, A., ii, 322.

Dustin, G. K. See **Henry Lord Wheeler**.

Dutoit, Paul, and **Louis Friderich**, surface tension of organic liquids, A., ii, 194.

Duyk, Maurice, perzone, a new indicator for alkalimetry, A., ii, 308.

Dymond, Thomas Southall, and **Frank Hughes**, injury to agricultural land on the coast of Essex by the inundation of sea-water on November 29th, 1897, A., ii, 307.

E.

Eberhardt, action of dry and moist air on plants, A., ii, 561.

Ebert, Hermann, and **Berthold Hoffmann**, phosphorescence of phosphoric oxide, A., ii, 517.

Ebner, A. See **Karl Auwers**.

Eckardt, Moritz, change of volume accompanying fusion of rubidium, A., ii, 400.

Eckardt, Moritz, and **Edmund Graefe**, physical properties of caesium, A., ii, 479.

Eckardt, Moritz. See also **Edmund Graefe**, and **Max Le Blanc**.

Eckhard, F. See **Frédéric Reverdin**.

Edeleanu, Lazar, and **G. A. Filti**, Roumanian petroleums, A., ii, 486.

Eder, Josef Maria, and **Eduard Valenta**, spectrum of chlorine, A., ii, 72.

— spectrum of bromine, A., ii, 330.

Eggerly, D. W. See **James F. Norris**.

Edleson, G., detection of phenetidine in urine, A., ii, 378.

Edmed, Frank George, note on the action of dilute nitric acid on oleic and elaidic acids, P., 1899, 190; discussion, P., 191.

Edmunds, Walter, effects of thyroid feeding on monkeys, A., ii, 224.

Effront, Jean, estimation of the products of digestion with pepsin, A., ii, 59.

Edmoff. See **Wladimir B. Markownikoff**.

Efross, M. See **Alexander P. Sabanéeff**.

Ehlert, F. G. See **F. W. Alden**.

Eichleiter, C. Friedrich, coals, bitumen, etc., from the Silurian of Bohemia, A., ii, 354.

Eichwald, E. See **Karl A. Hofmann**.

Eichwede, Heinrich. See **Johannes Thiele**.

Eijk, C. van, formation and transition of mixed crystals of potassium and thallium nitrates, A., ii, 133.

— formation and transformation of the double salts of thallium and silver nitrates, A., ii, 403.

Eijk, C. van. See also **Ernst Cohen**.

Einhorn, Alfred, reduction of benzyl-aminocarboxylic acids [aminophenyl-acetic acids], A., i, 227.

Einhorn, Alfred [and in part **Hugo Hüts**, and **Balthasar Pfyl**], new drugs [aromatic hydroxy-acids and esters], A., i, 439.

Einhorn, Alfred, and **Carl Ladisch**, reduction of p-benzylaminocarboxylic acid [p-aminophenylacetic acid], A., i, 227.

- Einhorn, Alfred**, and **Max Oppenheimer**, new drugs: glycyl derivatives of the esters of aromatic amino- and hydroxyamino-acids, A., i, 493.
- Einhorn, Alfred**, and **Stavros C. Papastavros**, reduction of *p*-diethylbenzylaminocarboxylic [*p*-diethylaminophenylacetic] acid, A., i, 228.
- Einhorn, Alfred**, and **Hermann Pfeiffer**, action of sodium and amyl alcohol on phenylaminoacetic acid, A., i, 221.
- benzylbutylamines, A., i, 222.
- Ekenstein, Alberda van**. See **Alberda van Ekenstein**.
- Elfstrand, Marten**, action of some aliphatic compounds, A., ii, 423.
- Ellinger, Alexander**, constitution of lysine, A., i, 143.
- Elliott, Walter John**, action of chloroform and potassium hydroxide on *o*-aminobenzoic acid, T., 213; P., 1899, 243.
- Ellis, W. Hodgson**, and **William Lawson**, anthracite and anthraxolite from Canada, A., ii, 660.
- Eltschaninoff, E.** See **Pavel I. Petrenko-Kritschenko**.
- Emden, Robert**, phenomena of effusion of permanent gases, A., ii, 10.
- Emery, A. L.**, soil humus; some sources of error in analytical methods, A., ii, 516.
- Emery, J. A.**, and **Frank Kenneth Cameron**, freezing point curve for water containing hydrogen chloride and phenol, A., ii, 335.
- Emieh, Friedrich**, and **Friedrich Dörner**, lecture experiment on the law of multiple proportions, A., ii, 340.
- Emmerich, Rudolf**, and **Oscar Loew**, bacteriological enzymes as a cause of immunity, and their healing action in infective diseases, A., ii, 159.
- Emmerich, W.** See **Alfred Wohl**.
- Emmerling, Adolf**, formation of proteids in plants, A., ii, 612.
- composition of fodders, A., ii, 614.
- Emmerling, Adolf**, and **H. Wehnert**, composition of the soil under paved and other manure courts at different depths, A., ii, 505.
- Emmerling, Oskar**, attempts to prepare a diaminovaleric acid, A., i, 16.
- schizomycetic fermentation, A., ii, 742.
- Enell, Henrik**, Bettendorfs arsenic test, A., ii, 244.
- Engel, Rodolphe [Charles]**, anhydrous magnesium carbonate, A., ii, 17.
- Engelen, Alph. van**, the Bechi test, A., ii, 116.
- Engels, Otto**, addition of formaldehyde to 2:4-lutidine: decomposition of 2:4-lupetidine into its optical isomerides, A., i, 406.
- Engler, Adalbert**, antidiazonaphthalene salts and naphthylnitrosoamine, A., i, 568.
- Engler, Adalbert**, and **Arthur Hantsch**, diazonium hydroxides and diazohydroxides, A., i, 566.
- Engler, Carl**, formation of petroleum, A., ii, 216.
- Engler, Carl** [and in part with **J. Weissborg**], the rendering active of oxygen, A., i, 399.
- English, Eugen**, theory of the latent image, A., ii, 381.
- Ensenauer, Joseph**. See **Fritz Fichter**.
- Erben, Franz**, composition of the fat of human chyle, A., ii, 739.
- Erben, Franz**. See also **C. von Stejskal**.
- Erdmann, Ernst**, the sense of smell and the most important perfumes, A., ii, 357.
- Erdmann, Ernst**, and **Hugo Erdmann**, neroli (orange blossom) oil, A., i, 556.
- Erdmann, Hugo**, naphthalene-1:3:5-trisulphonic acid, A., i, 91.
- malic acid from *Hippophaë rhamnoides*, A., i, 135.
- 4-hydroxycarbostryl from anthranilic acid, A., i, 188.
- detection and estimation of very small quantities of nitrous acid, A., ii, 243.
- behaviour of perfumes with liquid air, A., ii, 463.
- Erdmann, Hugo**, and **M. von Unruh**, analysis of calcium carbide, A., ii, 511.
- Erggelet, R. (Freiherr) von**. See **Karl Auwers**.
- Erlenmeyer, Emil, jun.**, action of benzyl cyanide on ethyl cinnamate, A., i, 493.
- α -amino-acids, A., i, 549.
- action of phenylhydrazine and of hydroxylamine on ethyl phenyleyanopyruvate, A., i, 649.
- Ernst**. See **Josef Tamber**.
- Ernst, Harold C.**, and **W. H. Robey, jun.**, mechanism of agglutination, A., ii, 560.
- Errera, Giorgio**, mixed methenyl compounds. I. and II. Action of ethyl ethoxymethyleneacetacetate and ethoxymethylenemalonate on ethyl acetonedicarboxylate, A., i, 33.
- Esch, Werner**, and **Wilhelm Marekwald**, ethylenetrimethylenediamine and methylpiperazine, A., i, 336.

Eschbaum, Friedrich, elimination of mercury by patients treated with this metal, A., ii, 358.

— clinical estimation of mercury in urine; elimination of mercury in patients treated with this metal, A., ii, 368.

Estecourt, Charles, butters from various countries compared, A., ii, 452.

Estreicher, Tadeusz, *sec.*-butylbenzene, A., i, 218.

— solubility of argon and helium in water, A., ii, 205.

Étard, Alexandre [Léon], oxidation of the nature of dehydrogenation by means of ferricyanides; oxidation of camphor, A., i, 301.

— hydrolysis of fibrous tissues, A., i, 468.

Ettlinger, J. See *R. Fosse*.

Euler, Hans, solubility of ethyl acetate in aqueous salt solutions, A., ii, 196.

— catalysis with normal salts, A., ii, 269.

— theory of catalytic actions, A., ii, 532.

Euler, Wilhelm, gravimetric estimation of zinc as sulphate, A., ii, 760.

Eury, J., source of error in the detection of sugar in urine by means of Fehling's solution, A., ii, 249.

Eustis, Allan C., proportion of basic nitrogen in elastin, A., i, 317.

Evans, Thomas, ricinine, A., i, 309.

Evers, Ferd., testing storax, A., ii, 118.

Ewan, Thomas, osmotic pressure of concentrated solutions, A., ii, 195.

Ewers, Erich. See *Julius Troeger*.

Ewert, R. See *Oscar Kellner*.

Eyme, A. See *Wilhelm Traube*.

Eynon, Lewis. See *Raphael Meldola*.

F.

Faber, H. See *C. Aschman*.

Faber, Harald [Nicolas], composition of Danish butter, A., ii, 696.

Fahrenheit, Johannes. See *Theodor Posner*.

Fahrion, Wilhelm, analysis of glue and leather, A., ii, 59.

— the inner saponification number, A., ii, 251.

Faktor, Fr., action of sodium thiosulphate on potassium antimony tartrate, A., ii, 598.

— action of sodium thiosulphate on mercuric salts, A., ii, 627.

— action of sodium thiosulphate on lead salts, A., ii, 688.

Faktor, Fr., action of sodium thiosulphate on certain metallic salts and its employment in quantitative analysis, A., ii, 691.

— action of sodium thiosulphate on bismuthic, ferrous, and ferric salts, A., ii, 692.

Fallose. See *Justin Winter*.

Faltin, Adolf. See *Tamas Kosutány*.

Farmer, J. Breiland, effect of desiccation of albumin on its coagulability, A., i, 572.

Farmer, Robert C., and *Arthur Hantzsch*, α -oximinoketones and quinoneoximes as pseudo-acids, A., i, 103.

— constitution of the so-called oxyazo-compounds, A., i, 122.

Farnsteiner, K., separation of oleic acid from other unsaturated acids, A., ii, 767.

Farr, E. H., and *Robert Wright*, estimation of strychnine, A., ii, 778.

Farrington, F. H., estimation of fat in sweetened condensed milk by the Babcock test, A., ii, 771.

Farup, P., simple and accurate method for the estimation of mercury in urine, A., ii, 689.

Fascetti, G., and *F. Ghigi*, detection of margarine in cheese, A., ii, 377.

— composition of the alluvial soil of Lodi, A., ii, 615.

Faust, Edwin S., alkaloids of the salamander, A., i, 186.

Fauvel, Pierre, the pigment of the *Arenicola*, A., ii, 227.

Favrel, G., action of acetylcyanacetic esters on benzenediazonium and diphenyltetrazonium chlorides, A., i, 532.

Fay, Henry. See *James F. Norris*.

Fedoroff, Eugraph S. von, and *W. W. Nikitin*, minerals from the Bogoslawsk district, Urals, A., ii, 486.

Fehlhaber, F. See *Leopold Rügheimer*.

Feilitzen, Carl von, soil analyses, A., ii, 504.

Feilitzen, Hjalmar von, experiments with alinit, A., ii, 433.

Feist, Franz, sugar obtained by the hydrolysis of strophanthin, IV., A., i, 540.

— origin of, and relations between, the glucosides of *Strophanthus*, A., i, 555.

— strophanthin and strophanthidin, A., i, 555.

— hydrazones and osazones from *p*-nitrophenylhydrazine, A., i, 569.

Feist, Karl. See *Franz M. Littarscheid*.

Fels, G., isomorphous replacement of halogens and hydroxyl, A., i, 338.

- Fenner, Gottfried, and Julius Tafel**, abnormal aurichlorides of organic bases, A., i, 111.
- Fenton, Henry John Horstman**, degradation of glycollic aldehyde, T., 1294; P., 1900, 148.
- Fenton, Henry John Horstman, and Humphrey Owen Jones**, the oxidation of organic acids in presence of ferrous iron, T., 69; P., 1899, 224.
- oxalacetic acid, T., 77; P., 1899, 224.
- Féré, Jules**. See *Antoine Gunz*.
- Ferguson, Alexander R.** See *R. S. Thomson*.
- Fernbach, Aug., and L. Hubert**, proteolytic diastase of malt, A., i, 576.
- influence of phosphates and other inorganic compounds on the proteolytic diastase of malt, A., i, 616.
- Fernberger, Harry M., and Edgar Francis Smith**, electrolysis of metallic phosphate solutions, A., ii, 109.
- Ferreira da Silva, Antonio Joaquim**, a cause of error in testing for salicylic acid in wines, A., ii, 695.
- Ferreira da Silva, Antonio Joaquim, and Alberto d' Aguiar**, fluorine in the mineral waters of Portugal and Spain, A., ii, 28.
- Ferretto, L.**, critical temperatures of some organic sulphur compounds, A., ii, 386.
- Fertig, Eduard**. See *Ludwig Wolff*.
- Fessel, F.**, physiological action of bromine, A., ii, 227.
- Feuerstein, W.** See *Arthur Haffter, Stanislaus von Kostanecki, and Emilio Nötling*.
- Fichter, Fritz, and Camille Dreyfus**, behaviour of dibasic β -hydroxy-acids on boiling with aqueous sodium hydroxide, A., i, 426.
- Fichter, Fritz, Joseph Ensenauer, and Emil Uellenberg**, 1-phenyl-4-methylpyrazolone, A., i, 312.
- Fichter, Fritz, and E. Katz**, ethereal oil of poplar buds, A., i, 108.
- Fichter, Fritz, and Albert Krafft**, vinylacetic acid, A., i, 8.
- Fichter, Fritz, and Emanuel Schiess**, colouring matters of the formazyl group, A., i, 366.
- Fieber, Rudolf**, simple method for decomposing chrome iron ore, A., ii, 512.
- colorimetric estimation of nickel in steel, A., ii, 628.
- Filatoff, P.** See *Friedrich Kehrman*.
- Filehne, Wilhelm**, action of santonin and amyl nitrite on vision, A., ii, 424.
- Filiti, G. A.** See *Lazar Eddeleanu*.
- Finckh, Curt von**. See *Richard Steerm*.
- Findlay, Alexander**, theory of the fractional precipitation of neutral salts, and its application in analytical chemistry, A., ii, 716.
- Fink, Isidor**. See *Josef Klaudy*.
- Fiquet, Edmond**, physiological action of nitriles, A., ii, 424.
- Fischer, Alois, and Berthold Winter**, action of sulphuric acid on dimethylpropanediol, A., i, 472.
- Fischer, Armin**. See *Paul Cohn*.
- Fischer, Bernhard**, volumetric estimation of boric acid, A., ii, 367.
- Fischer, Emil**, resolution of racemic compounds into active components, A., i, 140.
- resolution of racemic amino-acids into optically active components, A., i, 172, 646.
- aromatic derivatives of uric acid, A., i, 417.
- Fischer, Emil, and Friedrich Ach**, isomerism of the methyluric acids, A., i, 63.
- Fischer, Emil, and Wolf von Loeben**, 3-phenylpurine, A., i, 697.
- Fischer, Emil, and Antoine Mouneyrat**, resolution of racemic amino-acids into optically active components, IV., A., i, 647.
- Fischer, Emil, and Otto Ruff**, conversion of gulonic acid into xylose and galactose, A., i, 539.
- Fischer, Emil, and Adolf Windaus**, formation of quaternary ammonium compounds in the case of homologues of aniline, A., i, 224.
- formation of quaternary ammonium compounds in the case of brominated homologues of aniline, A., i, 484.
- Fischer, Otto, and Eduard Hepp**, constitution of the rosinduline of the aminoazobenzene fusion, A., i, 462.
- Fischer, Otto, and Eduard Hepp** [with *Fried. Linnemann, Alexander Gutbier, and Walther Diltthey*], safranine and rosinduline, A., i, 460.
- Fischer, Richard**. See *Hans Stobbe*.
- Fischer, Robert**. See *William McPherson*.
- Fisher, Henry**. See *O. C. Beck, and Edmund Howard Miller*.
- Fittica, Friedrich**, [alleged] conversion of phosphorus into arsenic and into antimony, A., ii, 651.
- Fittig, Rudolph**, formation of oxalacetic acid by oxidation with potassium permanganate in alkaline solution, A., i, 375.

- Fittig, Rudolph**, isomeric phenylparaconic acids, A., i, 397.
- Flath, J.**, dry assay of lead, A., ii, 512.
- Flatow, L.** See **Carl Liebermann**.
- Fleck, Hermann**. See **Edgar Francis Smith**.
- Flemming, Hugo**, preparation of carbamide from guanidine, A., i, 280.
- Fleroff, A.**, histon-like substance from the thymus, A., i, 71.
- Fletcher, Lazarus**, meteoric iron from Caperr, Patagonia, A., ii, 27.
- cliftonite and tenite in the Younegin meteoric iron, A., ii, 27.
- Fleury, Gustave [Clement]**, specific heats of some organic substances, A., ii, 188.
- Flink, Gustav**, minerals from Narsarsuk, S. Greenland, A., ii, 410.
- Foerster, Fritz**, theory of the electrolytic formation of hypochlorite and chlorate, A., ii, 72.
- electrolysis of solutions of alkali chlorides, A., ii, 400.
- Foerster, Fritz**, and **F. Jorje**, electrolysis of alkali chloride solutions with a diaphragm, A., ii, 343.
- Foerster, Fritz**, and **H. Sonneborn**, evolution of oxygen at the anode in the electrolysis of solutions of alkali chlorides, A., ii, 645.
- Foggetti, Lucien**, receiver for fractional distillation in a vacuum, A., ii, 535.
- Fomin, A.**, analysis of bronzes, A., ii, 109.
- Fonnes-Diacon, Henri**, zinc selenide and its dimorphism, A., ii, 345.
- a crystallised selenide and an oxy-selenide of manganese, A., ii, 348.
- lead selenides and chloroselenides, A., ii, 402.
- preparation of aluminium [sulphide, selenide, phosphide, and arsenide], A., ii, 405.
- iron selenides, A., ii, 546.
- nickel selenides, A., ii, 730.
- Foot, H. W.**, physico-chemical relations of aragonite and calcite, A., ii, 541.
- Foot, Warren M.**, meteoric iron from Iredell, Texas, A., ii, 150.
- Foreheimer, J.**, electromagnetic rotation of the plane of polarisation in solutions of salts and acids, A., ii, 524.
- Forcrand, Robert de**, hydrate of sodium peroxide and preparation of hydrogen peroxide, A., ii, 129.
- action of hydrogen peroxide on barium hydroxide, A., ii, 277.
- hydrated barium peroxides, A., ii, 344.
- heat of formation of hydrated and anhydrous strontium dioxide, A., ii, 344.
- Forcrand, Robert de**, hydrated calcium peroxides, A., ii, 401.
- dihydroxides, A., ii, 476.
- lithium peroxide, A., ii, 478.
- anhydrous calcium peroxide, and the constitution of its hydrates, A., ii, 479.
- heat of neutralisation of hydrogen peroxide by lime, A., ii, 526.
- heat of dissolution of hydrogen peroxide; thermal value of the hydroxyl function; influence of hydrogen and carbon, A., ii, 526.
- acidity of alcohols, A., ii, 527.
- general theory of acidity, A., ii, 528.
- Ford, Allen P.**, and **Ivan M. Bregowsky**, estimation of graphitic carbon in cast iron and pig iron, A., ii, 168.
- Formánek, Emanuel**, action of chloroform and chloral hydrate on hæmoglobin, A., i, 532.
- Formánek, Julius**, treatment of lepidolite, A., ii, 15.
- a new indicator, A., ii, 435.
- detection of metals by the absorption spectra of their compounds with alkanna, A., ii, 687.
- Forster, Martin Onslow**, studies in the camphane series. I. Nitrocamphane, T., 251; P., 1900, 13.
- Forster, Martin Onslow**, and **James Hart-Smith**, separation of neobornylamine from bornylamine, T., 1152; P., 1900, 166.
- Fortey, Emily C.** See **Sydney Young**.
- Fosse, R.**, acetals from phenols, A., i, 298.
- Fosse, R.**, and **J. Ettlinger**, action of ethylidene chloride on phenols, A., i, 392.
- Foulerton, A. G. R.** See **Samuel Rideal**.
- Fouqué, Ferdinand**, melilite group of minerals, A., ii, 551.
- Fradiss, N.**, estimation of hyposulphurous acid, A., ii, 44.
- Fränkel, I.** See **Carl Liebermann**.
- Fränkel**. See **Carl Adam Bischoff**.
- Fränkel, Sigmund**, chemical behaviour of drugs and poisons in the organism, A., ii, 423.
- Fränkel, Sigmund**. See also **Theodor Rob. Offer**.
- Francesconi, Luigi**, constitution of santonic and metasantonic acids and of metasantonin, A., i, 101.
- Franchimont, Antoine Paul Nicolas**, action of acetic anhydride on cellulose in presence of sulphuric acid, A., i, 141.
- plumieride and its identity with agoniadin, A., i, 680.

- Francis, Francis E.**, isomeric dibenzyl ketone benzalanilines, and deoxybenzoin benzalanilines. Part II., T., 1192; P., 1900, 169.
- François, Maurice**, dissociation by water of ammonium and potassium mercuriodides, A., ii, 142.
- action of ammonia on diammonio-mercuric iodide, A., ii, 208.
- anhydrous dimercuriammonium iodide, amorphous and crystalline, A., ii, 280.
- formation of mercuriammonium iodide by the regulated action of concentrated ammonia on mercuriammonium iodide, A., ii, 346.
- Frank, Bernhard**, inoculation with nitragin, A., ii, 298.
- Franke, Adolf**, transformation of bis-isopropylazimethylene [isobutaldazine] into 4:4-dimethyl-5-isopropylpyrazoline, A., i, 212.
- action of bromine on polymeric aldehydes, I., A., i, 427.
- 2-methyl-2-bromopropanal [α -bromo-isobutaldehyde], A., i, 428.
- Franke, Adolf**, and **Leopold Kohn**, isobutyrideneacetone and its derivatives, A., i, 206.
- Frankforter, George Bell**, *Astragalus caryocarpus*, A., ii, 747.
- Frankforter, George Bell**, and **E. P. Harding**, wheat, A., ii, 37.
- Franklin, Edward C.**, and **Charles A. Kraus**, electrical conductivity of liquid ammonia solutions, A., ii, 382.
- conductivity temperature coefficient of some liquid ammonia solutions, A., ii, 645.
- Fraps, George S.**, purification of phloroglucinol, A., i, 645.
- isomeric potassium sodium sulphites, A., ii, 276.
- digestibility of some non-nitrogenous constituents of certain feeding stuffs, A., ii, 748.
- wide occurrence of indicators in nature, A., ii, 754.
- Fraser, Joseph C. W.** See **Victor J. Chambers**.
- Freer, Paul C.**, action of benzoyl chloride on the phenylhydrazones of benzoïn, A., i, 124.
- Freitag, Hugo**, magnetic susceptibility of aromatic organic substances, A., ii, 708.
- French, William**, influence of finely divided platinum on the combination of hydrogen and oxygen, A., ii, 718.
- Frenzel, C.**, some properties of liquid ammonia, A., ii, 474.
- Frerichs, Gustav**, Bettendorff's arsenic test, A., ii, 244.
- Frerichs, Gustav**, and **Heinrich Beckurts**, the thiocynoacetic acids, A., i, 478.
- Fresenius, Wilhelm**, Abegg and Herz's method for the separation and recognition of acids, A., ii, 754.
- Fresenius, Wilhelm**, and **Leo Grünhut**, recognition of mare wines (Tresterweine), A., ii, 52.
- Freudenreich, Ed. von**, the organised ferment present in milk, the so-called galactase, A., i, 712.
- Freund, Martin** [and **Hugo Preuss**], cotarnine, A., i, 248.
- Freund, Walther**, excretion of sulphur in infants, A., ii, 226.
- Freundlich, J.**, determination of the solidifying point of fatty acids, A., ii, 250.
- Freundlich, J.**, and **Otto Rosauer**, reduction of oleic to stearic acid by the aid of nascent hydrogen, A., i, 581.
- Freyer, Franz**, estimation of sugar in glycerin-soaps, A., ii, 373.
- Friderich, Louis**. See **Paul Dutoit**, and **Philippe A. Guye**.
- Friedel, Charles**, memorial lecture on (Crafts), T., 993.
- Friedel, Jean**, influence of pressure on chlorophyllous assimilation, A., ii, 679.
- Friedenthal, Hans**, digestion of starch in the stomach of Carnivora, A., ii, 224.
- absorption of fats, A., ii, 668.
- Friedheim, Carl**, and **Ernst Brühl**, use of hydrogen peroxide in quantitative analysis, A., ii, 171.
- Friedheim, Carl**, and **C. Castendyk**, silicovanadiomolybdates, I., A., ii, 483.
- Friedheim, Carl**, and **Minna Samelson**, permanganomolybdates, A., ii, 547.
- Friedl, Arthur**, amino-derivatives of methylphloroglucinol, A., i, 593.
- Friedländer, Paul**, conversion of 1:5- and 1:8-dinitronaphthalenes into nitronitrosenaphthols, A., i, 150.
- Friedländer, Siegfried**, estimation of sulphur in petroleum, A., ii, 107.
- Friedmann, Ernst**, the nitrogen in primary albumoses, A., i, 265.
- Friis, F.**, experiments on feeding cows with mixed grain and maize, A., ii, 615.
- Fröbenius, Aug. Ludwig**, vanillin in vinegar essences, A., i, 603.
- Fromm, Emil**, history of thioacetaldehydes, A., i, 14.

- Fromm, Emil**, [and in part *W. Lischke*], oil of savin (*Oleum sabinae*), II., A., i, 402.
- Fromme, Johannes**, minerals from the Radautal, Harz, A., ii, 487.
- Fürth, Otto von**, the catechol-like substance of the suprarenals, A., ii, 292.
- Fulda, Hugo Ludwig**, condensation products of *o*-aldehydic acids with ketones, A., i, 36.
- benzoylpyridinecarboxylic acids, A., i, 53.
- Fuller, R. W.** See *Charles Loring Jackson*.
- Funaro, Angiolo**, analysis of beeswax, A., ii, 55.

G.

- Gabounia, A.** See *Wlatschiaslaw E. Tistschenko*.
- Gabriel, Siegmund**, and **James Colman**, derivatives of 4-methylpyrimidine [4-methyl-*m*-diazine], A., i, 53.
- constitution of naphthoylbenzoic acid, naphthanthraquinone, and naphthanthracene, A., i, 232.
- action of the sodium alkyl-oxides on ethyl phthalylaminoacetate and its homologues, A., i, 358.
- 4-hydroxyisocarbostyryl, A., i, 359.
- transformations of phthaliminoketones, A., i, 689.
- Gabutti, Emilio**, action of chloral on the chloroacetic acids, A., i, 370.
- Gaeh, Friedrich**, acetylacetone, A., i, 276.
- Gadamer, Johannes**, ethereal oils of cresses, and the glucosides from which they are formed, A., i, 49.
- alkaloids of the Solanaceæ, A., i, 356.
- Gahl**. See *Strasser*.
- Gahl, R.**, theory of vapour pressure, A., ii, 389.
- Gailhat, J.**, gasometric method of estimating nitrites in presence of nitrates or other soluble salts, A., ii, 686.
- Galitsin, (Prince) Boris L.**, and **J. Willp**, refractive power of ethyl ether near the critical point, A., ii, 461.
- Galitski, N.**, influence of the medium on the heats of solution of salts, A., ii, 66.
- Gallard, F.**, absorption of iodides by the skin, A., ii, 419.
- Gallien, L.**, analysis of milk, A., ii, 324.
- Gallinek, Alfred**, aminomethylnaphthimidazolesulphonic acid, A., i, 697.
- Galt, Alexander**, [negative heat of formation of alloys of zinc and copper], A., ii, 189.
- Gans, Ludwig**. See *Roman Zalosiecki*.
- Gardner, John Addyman**, note on the bromo-derivatives of camphopyric acid, P., 1900, 46.
- Garelli, Felice**, and **F. Calsolari**, cryoscopic behaviour of substances with constitutions similar to that of the solvent, A., ii, 65.
- Garnier, Léon**, and **Léopold Michel**, detection of nucleo-albumin in urine by means of tannin, A., ii, 58.
- influence of dextrose on the estimation of urea by the hypobromite method, A., ii, 699.
- Garrey, Walter E.**, effect of ions on flagellated infusoria, A., ii, 158.
- Garrod, Archibald Edward**. See *P. J. Cammidge*.
- Gautier, [Emile Justin] Armand**, preparation and estimation of glycogen, A., i, 81.
- estimation of glycogen, A., ii, 113.
- normal existence of arsenic in animals and its localisation in certain organs, A., ii, 152.
- detection and estimation of very small quantities of arsenic in the organs, A., ii, 168.
- localisation, elimination, and origin of arsenic in animals, A., ii, 226.
- tubular furnace giving fixed temperatures, adjustable at will, A., ii, 258.
- gas absorption apparatus, A., ii, 366.
- limits of combustibility of hydrogen and gaseous hydrocarbons when diluted with large volumes of air and passed over red hot cupric oxide, A., ii, 469.
- combustible gases of the atmosphere; air of towns, A., ii, 537.
- combustible gases of the atmosphere; air of forests and high mountains, A., ii, 537.
- combustible gases of the atmosphere; air of the sea; existence of free hydrogen in the terrestrial atmosphere, A., ii, 538.
- rôle of arsenic in connection with the menstrual flow, A., ii, 670.
- nature of the accessory combustible gases in the air of Paris, A., ii, 720.
- Gautier, Henri**, atomic weight of boron, A., ii, 14, 15.
- Gazzolo, F. H.** See *Charles Loring Jackson*.
- Geelmuyden, H. Chr.**, reducing action of calcium carbide, A., ii, 344.
- Geiger, M.**, velocity of reaction of acids in organic solvents, A., ii, 394.
- Geisler, Joseph F.**, estimation of fat in sweetened condensed milk, A., ii, 771.

- Geitel, Adolf C.**, and **G. van der Want**, Japan wax, A., i, 271.
- Gelder, Arthur P. van**, analysis of nitric acid and mixed acid [nitric and sulphuric], A., ii, 621.
- Genyresse, P.**, new terpenoid alcohol and its derivatives, A., i, 351.
- Georgesou, M.**, aromatic esters of sulphurous acid, A., i, 343.
- Georgievics, Georg von**, coloured rosaniline bases and their colouring properties, A., i, 569.
- Georgievics, Georg von**, and **L. Springer**, oxidation [of indigotin], A., i, 560.
— oxidation [of oxalic acid by potassium permanganate], A., ii, 631.
- Gérard, Ernest**. See **J. E. Abelous**.
- Gerhardt, D.**, estimation of phosphorus by Reed's method, A., ii, 108.
- Gerilowski, Dimitër W.**, syndiazotates from *p*-bromodiazobenzene-*o*-sulphonic acid, A., i, 706.
- Gerin, F.** See **Léo Vignon**.
- Gernex, Désiré**, transformation temperature of the quadratic and orthorhombic forms of mercuric iodide, A., ii, 141.
- Geroock, J. E.**, detection of salicylic acid in presence of citric acid, A., ii, 769.
- Gesché, Louis**, action of potassium hydroxide on dyponne, A., i, 604.
- Gessard, C.**, tyrosinase, A., i, 468.
- Geuns, J. W. van**, explosiveness of a mixture of potassium cyanide and nitrite, A., i, 636.
- Ghigi, F.** See **G. Fascetti**.
- Gibson, Harriet Winfield**. See **Hermann T. Vulte**.
- Gibson, John**, characteristics of certain chemical reactions, A., ii, 198.
- Giertz, K. H.**, pseudo-nucleins, A., i, 71.
- Gies, William J.**, mucin from bone, A., i, 317.
- Gies, William J.**, and **Leon Asher**, influence of protoplasmic poisons on lymph formation, A., ii, 291.
- Gies, William J.**, and **William D. Cutler**, glucoproteids of white fibrous tissue, A., ii, 293.
- Gies, William J.**, and **L. D. Mead**, physiological action of tellurium compounds, A., ii, 294.
- Gies, William J.**, and **A. N. Richards**, coagulable proteids of connective tissues, A., ii, 292.
- Gies, William J.** See also **Leon Asher**.
- Giesel, Fritz**, radio-active barium salts and polonium, A., ii, 19, 480.
- Gillardoni, H.** See **Louis Lapicque**.
- Gilbert, Ad.** See **Otto Wallach**.
- Gilbert, Sir Joseph Henry**. See **Sir John Bennet Lawes**.
- Gilbody, Alexander William**, and **William Henry Perkin, jun.**, on brazilin and haematoxylin, P., 1899, 241.
- Gilbody, Alexander William, William Henry Perkin, jun.**, and **J. Yates**, on brazilin, IV., P., 1900, 105.
- Gill, Augustus H.**, and **Waller O. Adams**, Hübl's iodine method for oil analysis, A., ii, 323.
- Gillern, H. von**. See **Oscar Kellner**.
- Gillot, Henri**, inverting power of tartaric, citric, and oxalic acids on sucrose, A., i, 208.
— raffinose as a carbohydrate for the nutrition of *Aspergillus niger*, A., ii, 99.
- Ginsburg, Z.** See **Alexander P. Sabanéeff**.
- Gintl, Wilhelm, jun.** See **Otto Gras**.
- Giorgia, Giovanni**, and **Ugo Alvisi**, natural and artificial pozzuolana, A., ii, 348, 545.
- Giran, H.**, new compounds of phosphoric oxide with benzene, A., i, 146.
- Girard, Julien**, estimation of silver on plated copper utensils, A., ii, 170.
- Gladstone, John Hall**, want of uniformity in the action of copper zinc alloys on nitric acid, A., ii, 710.
- Gley, Eugène**, and **Paul Bourcet**, iodine in the blood, A., ii, 555.
- Gley, Eugène**. See also **L. Camus**.
- Glinka, Konstantin D.**, hydrated aluminium silicates and clays, A., ii, 89.
- Gnehm, Robert**, and **H. Werdnberg**, diphenylamine derivatives, especially sulphonic acids, A., i, 98.
- Gockel, Albert**, electrolytic decomposition point of aqueous solutions, A., ii, 332.
— relations between polarisation and current density in solid and fused salts, A., ii, 704.
- Göckel, Heinrich**, new pyknometer for the determination of the specific gravity of light liquids, A., ii, 193.
- Götsel, Alb.** See **Giulio Morpurgo**.
- Gohs**. See **Carl Adam Bischoff**.
- Goldberg, Irma**. See **Fritz Ullmann**.
- Golding, John**, sugar as an aid to the growth of plants, A., ii, 617.
- Goldschmidt, Carl**, action of formaldehyde on anilides, A., i, 285.
— reactions of formaldehyde, A., i, 436.
— action of formaldehyde on methyl-aniline, A., i, 436.
- Goldschmidt, Heinrich**, and **Gustav Keppeler**, dynamical researches on the formation of azo-dyes, IV., A., i, 367.

- Goldschmidt, Heinrich**, [with *Anton Messerschmitt*], velocity of reaction in heterogeneous systems, A., ii, 200.
- Goldschmidt, Heinrich**, and *Lazar Oslan*, ethyl acetacetate, A., i, 132, 373.
- Goldschmidt, Max**. See *Wilhelm Wislicenus*.
- Goldschmidt, Victor**, vanadinite (endolichite) from Hillsboro', New Mexico, A., ii, 600.
- Goldschmiedt, Guido**, and *Gustav Knöpfer*, condensation of dibenzyl ketone with benzaldehyde, A., i, 35.
- Goldstein, Eugen**, phosphorescence of inorganic substances, A., ii, 702.
- Gomberg, Moses**, diazocaffeine, A., i, 263.
- Gomes, Jacinto Pedro**, libollite, A., ii, 86.
- Goeh, Frank Austin**, and *Martha Austin*, composition of ammonium magnesium phosphate, A., ii, 108.
- Goeh, Frank Austin**, and *de Forest Baldwin*, action of acetylene on oxides of copper, A., i, 74.
- Goeh, Frank Austin**, and *Frederick H. Morley*, iodometric estimation of gold, A., ii, 110.
- Goeh, Frank Austin**, and *Julia C. Morris*, iodometric estimation of arsenic acid, A., ii, 636.
- Goeh, Frank Austin**, and *C. A. Peters*, estimation of tellurous acid in presence of haloid salts, A., ii, 45.
- Goodbody, Francis W.**, influence of sodium salicylate on metabolism, A., ii, 670.
- Goodechild, George John**, genesis of some Scottish minerals, A., ii, 733.
- Goodman, J. H.**, connective tissue in muscle, A., ii, 671.
- Goodwin, William L.**, analyses of corundum and corundum-bearing rock, A., ii, 661.
- Goodwin, William L.**, and *Willet G. Miller*, a mineral of the columbite group, A., ii, 662.
- Gordin, Harry Mann**, the alkaloids of *Ceanothus americanus*, A., i, 683.
- simple alkalimetric method for the estimation of salt-forming alkaloids with the aid of phenolphthalein as indicator, A., ii, 119.
- modified alkalimetric method for the valuation of opium, and other pharmaceutical drugs and preparations that contain alkaloids, A., ii, 777.
- Gordon, James S.**, experiments on potatoes, A., ii, 238.
- Goret, Maurica**, composition of the albumen of the seed of the American bean (*Gleditschia triacanthos*), A., ii, 562.
- Gorni, F.** See *Giuseppe Bruni*.
- Goto, Motonosuke**, solubility of uric acid in nucleic and thymic acids, A., ii, 740.
- Goto, Motonosuke**. See also *Albrecht Kossel*.
- Gotsch, F.** See *Franz Kunczell*.
- Gotthelf, August Henry**. See *Marston Taylor Bogert*.
- Gottlieb, Rudolf**, amount of urea in the liver, A., ii, 29.
- estimation of urea in the tissues, and the amount contained in the liver, A., ii, 57.
- Gottschalk, V. H.** See *Eugene T. Allen*.
- Goulding, Ernest**. See *Wyndham Rowland Dunstan*.
- Gourevitz, S.** See *Carl Graebe*.
- Goutal, E.** See *Adolphe Carnot*.
- Gouy, A.**, action of water on mercurous sulphate, A., ii, 481.
- Goyder, George A.**, sulvanite a new mineral, T., 1094; P., 1900, 164.
- Graebe, Carl**, conversion of 1:8- and 1:5-dinitronaphthalenes into nitro-nitrosenaphthols, A., i, 24.
- constitution of chrysenic acid, A., i, 296.
- commercial dichlorophthalic acid, A., i, 546.
- formation of esters in the phthalic acid group, A., i, 547.
- Graebe, Carl**, and *S. Gourevitz*, 3:6-dichlorophthalic acid, A., i, 547.
- Graebe, Carl**, and *F. Hönigsberger*, oxidation products of chrysene, A., i, 505.
- Graefe, Edmund**, and *Moritz Eckardt*, preparation of caesium from the carbonate, A., ii, 75.
- Graefe, Edmund**. See also *Moritz Eckardt*.
- Gräfenhan, Wilhelm**. See *Richard Stoermer*.
- Gräler, Karl Paul**. See *Richard Stoermer*.
- Graftian, J.**, composition of the very rich sugar beet of the season 1898, A., ii, 430.
- Grande, Ernesto**. See *Icilio Guareschi*.
- Grandis, Valentino**, elimination of carbon dioxide during respiration. I. Influence of the concentration of the blood on the tension of the carbon dioxide in it, A., ii, 604.
- elimination of carbon dioxide during respiration. II. Influence of the hygrometric state on the passage of carbon dioxide from the blood to the air, A., ii, 604.
- composition of the placenta; its solid and liquid components, organic compounds, extractive matter, and albumoses, A., ii, 608.

- Grandis, Valentino**, composition of the ash of the placenta, A., ii, 609.
- Grandis, Valentino**, and **C. Mainini**, colour reactions for detecting calcium salts in organic tissues, A., ii, 625.
- Granger, Albert**, and **Gaston Didier**, nickelous arsenide, A., ii, 349.
- Gras, Otto**, and **Wilhelm Gintl, jun.**, application of the Kjeldahl method of destroying organic matter in the detection of metals, A., ii, 111.
- Grassberger, R.** See **Arthur Schattenfroh**.
- Grassini, R.**, sodium amylxanthate in qualitative analysis, A., ii, 510.
- Gray, Archibald.** See **Edmund James Mills**.
- Gray, Harry Le B.** See **Henry Lord Wheeler**.
- Gray, Thomas**, syntheses with acetylacetone, A., i, 376.
- Green, Arthur George**, orthoquinonoid structure of safranine, oxazine, and thiazine colouring matters, A., i, 119.
- Green, Joseph Reynolds.** See **Harry Marshall Ward**.
- Gregor, A.**, estimation of the reducing substances in urine by Peske's method, A., ii, 94.
- Gregor, Georg**, analysis of Cayenne pepper, A., ii, 775.
- Gregor, Georg.** See also **Neuman Wender**.
- Gregory, Herbert E.**, andesites from Maine, A., ii, 90.
- Gréhan, Nestor**, acute alcoholism; estimation of alcohol in the blood and tissues, A., ii, 95, 112.
- Greimer, Karl**, poisonous Boraginæ alkaloids, A., i, 688.
- Greshoff, Maurits**, phytochemical studies. I. Distribution of alkaloids in the Compositæ, A., i, 556.
- Grey, G.** See **Archibald Liversidge**.
- Griffa, Martin L.**, estimation of sulphur dioxide in sulphites and thiosulphates, A., ii, 621.
- Griffiths, Arthur Bower**, green pigment of *Amanita muscaria*, A., ii, 235.
- colouring matter of *Echinus esculentus*, A., ii, 677.
- ashes of some medicinal plants, A., ii, 679.
- Griffon, Ed.**, chlorophyllous assimilation induced by sunlight filtered through leaves, A., ii, 159.
- chlorophyllous assimilation in indoor plants, A., ii, 426.
- Grignard, V.**, new organo-metallic compounds of magnesium, and their application to the synthesis of alcohols and hydrocarbons, A., i, 382.
- Grigorowitsch, P.**, synthesis of β -p-isopropylphenyl- α -methylhydracrylic acid, A., i, 597.
- Grimbert, Léon**, action of *Bacillus coli* and *B. d'Eberth* on nitrates, A., ii, 97.
- Grimbert, Léon**, and **G. Legros**, identity of the ærogenic bacillus of milk with the pneumobacillus of Friedländer, A., ii, 493.
- Grimm, A.** See **Martin Ullmann**.
- Grimm, Rud.**, spontaneous combustion of coals, A., ii, 205.
- Gröger, Max**, copper carbonate, A., ii, 542.
- Greeneveld, A.** See **Wilhelm Dieckmann**.
- Groneberg, Max**, benzylidene derivatives of triaminodiphenylamine, A., i, 260.
- Gronover, A.** See **Alfred Partheil**.
- Gross, Alfred.** See **Richard Stoermer**.
- Gross, Emanuel**, assimilation by plants in soils containing different amounts of sand, A., ii, 363.
- Gross, Emanuel.** See also **Josef Seisal**.
- Grossmann, S.**, and **Stanislaus von Kostanecki**, 4'-hydroxyflavone, A., i, 669.
- Grousinoﬀ, A. A.**, change in composition of liquid air on evaporation, A., ii, 720.
- Grünhut, Leo**, and **Severin H. R. Riiber**, estimation of sucrose in condensed milk, A., ii, 249.
- Grünhut, Leo.** See also **Wilhelm Fresenius**.
- Grünwald, Richard.** See **Robert Behrend**.
- Grüss, J.**, production of sucrose from dextrose in the cell, A., ii, 361.
- Grütsner, Bruno**, estimation of alkali persulphates and of hydrogen peroxide, A., ii, 310.
- compound of silver fluoride with ammonium fluoride, A., ii, 541.
- Guareschi, Icilio**, dicyanohydroxypyridones, A., i, 52.
- a new trimethylpyridine, A., i, 558.
- Guareschi, Icilio**, and **Ernesto Grande**, synthesis of glutaric and trimethylene derivatives, A., i, 111.
- action of heat on hydrogenised compounds, A., i, 112.
- Guédras, Marcel**, manufacture of glycerophosphates, A., i, 75.
- Günther, R. T.**, and **J. J. Manley**, waters of the Salt Lake of Urmi, Persia, A., ii, 220.
- Guépin, Henri**, cultivation of parsnip, A., ii, 751.
- Guerbet, M.**, composition of *E. Indian* essence of sandalwood, A., i, 242.

- Guerbet, M.**, santalenes and santalols, A., i, 401.
- Guess, H. A.**, gluten constituents of wheat and flour, and their relation to bread-making qualities, A., ii, 584.
- Guichard, Marcel**, molybdenum dioxide, A., ii, 80.
- molybdenum disulphide, A., ii, 144.
- a new crystalline molybdenum sulphide, A., ii, 211.
- [analysis of] molybdenum sulphides, A., ii, 370.
- the blue oxide of molybdenum, A., ii, 658.
- Guillemonat, A.** See *Albert Charrin*.
- Guillery**, effect of poisons on the eye-muscles, A., ii, 95.
- Guillos, Th.**, action of the constant current on the respiration of "surviving" muscle, A., ii, 221.
- Guldberg, Cato M.**, absolute molecular volumes, A., ii, 264.
- Gulewitsch, Wladimir von**, interaction of ammonium cyanide with acetone, A., i, 476.
- meningocele fluid, A., ii, 420.
- Gulewitsch, Wladimir von**, and *S. Amradzibi*, carnosine, a new base present in meat extract, A., i, 516.
- Guntrum**. See *Carl Adam Bischoff*.
- Gunts, Antoine**, and *Jules Férée*, sodium and potassium amalgams, A., ii, 540.
- Gustavson, Gabriel**, influence of hydrobromic acid on the rate of action of bromine on trimethylene, A., i, 535.
- Guthrie, Alexander**. See *Otto Fischer*.
- Guthrie, Frederick Bickell**. See *B. G. Corney*.
- Guye, Philippe A.**, and *Emily Aston*, rotatory power of active valeric acid, A., ii, 253.
- Guye, Philippe A.**, and *Louis Friderich*, calculations in connection with the equations of condition for liquids. I. Determination of the constants α and b of van der Waals' equation, A., ii, 709.
- Guyot, Alfred**. See *Albin Haller*.
- Gwosdareff, N. J.** See *Nicolai S. Kurnakoff*.
- H.**
- Haager, E.** See *Theodor Curtius*.
- Haaren, A. van**. See *Alfred Partheil*.
- Haarst, J. van**. See *F. F. Bruyning, jun.*
- Haase, E.** See *Ludwig Claisen*.
- Haasy, von**. See *Walther Hempel*.
- Haber, Fritz**, gradual electrolytic reduction of nitrobenzene with limited cathode potential, A., i, 281.
- electrolytic reduction of nitro-compounds, A., i, 592.
- electrical reduction of non-electrolytes, A., ii, 257.
- estimation of benzene and ethylene in coal gas, A., ii, 629.
- autoxidation, A., ii, 720.
- Haber, Fritz**, and *Fr. Bran*, autoxidation, II., A., ii, 720.
- Haber, Fritz**, and *Carl Schmidt*, electrolytic reduction of nitrobenzene, A., i, 282.
- Hackman, Victor** [ivaarite], A., ii, 664.
- Haensel, Heinrich**, liquorice oil, A., i, 107.
- Haessermann, Carl**, tertiary aromatic amines, III., A., i, 365.
- Hafner, B.**, estimation of glycyrrhizin in liquorice extract, A., ii, 328, 775.
- Haga, Tamemasa**. See *Edvard Divers*.
- Hagemann, Oskar**, metabolism in Ruminants, A., ii, 222.
- rational feeding of cows, A., ii, 502.
- Hagen, W.** See *Wilhelm His, jun.*
- Hagenbach, A.** See *A. Binz*.
- Haldane, John Scott**, cyanomethæmoglobin and photomethæmoglobin, A., i, 318.
- the supposed oxidation of carbonic oxide in the living body, A., ii, 221.
- the ferricyanide method of determining the oxygen capacity of blood, A., ii, 458.
- Haldane, John Scott**, and *James Lorrain Smith*, the percentage oxygen capacity and total oxygen capacity and the total mass of blood in man, A., ii, 416.
- mass and oxygen capacity of blood in man, A., ii, 665.
- Hall, A. D.**, assay of creosote, A., ii, 580.
- Hall, Clarence**. See *Edgar Francis Smith*.
- Hall, Edwin H.**, relation between pressure and evaporation, A., ii, 9.
- Hall, E. J.** See *Edmund Howd Miller*.
- Hall, Harold**. See *Frederic Stanley Kipping*.
- Hall, Robert W.**, cause of the loss in weight of commercial platinum when heated under some conditions, A., ii, 659.
- Haller, Albin**, reaction between aromatic aldehydes and the sodium derivative of borneol, A., i, 301.
- preparation of ethyl β -alkoxy- α -cyanocrotonates isomeric with ethyl cyanoalkylacetates, A., i, 372.

- Haller, *Albin*, and *G. Blanc*, synthesis of campholic acid by means of camphoric acid, A., i, 202.
- synthesis of ethyl β -cyano- α -dimethyltricarballoylate and α -dimethyltricarballoylic acid, A., i, 475.
- alkyl salts of α -cyano- β -alkyloxy- β -phenyl-, and β -benzyl-acrylic acids, A., i, 496.
- Haller, *Albin*, and *Alfred Guyot*, tautomerism of *o*-benzoylbenzoic acid, A., i, 170.
- Haller, *Albin*, and *Jules Minguin*, action of hydrogen bromide on dextrogyrate benzylidenecamphor, bromobenzylcamphor, and dextrogyrate benzylidenecampholic and phenylhydroxyhomocampholic acids, A., i, 452.
- Haller, *Albin*, and *Paul Thiebaut Muller*, molecular refraction and dispersion, and specific rotation of alkyl derivatives of camphor, A., i, 182.
- molecular volume of camphor derivatives, A., ii, 193.
- Halliburton, *William Dobinson*, physiological effects of extracts of nervous tissues, A., ii, 428.
- Hallepeau, *L. A.*, paratungstates, A., ii, 350.
- Hallepeau, *L. A.* See also *Marcel Delépine*.
- Halphen, *Georges*, detection of benzene in denatured alcohol, A., ii, 446.
- analysis of saccharine liquids, A., ii, 694.
- detection of foreign colouring matters in preserved tomatoes, A., ii, 700.
- Hamburger, *Hartog Jakob*, absorption of fats and soaps in the large intestine, A., ii, 418.
- lipolytic ferment in human ascitic fluid, A., ii, 420.
- investigation of urine by a combination of the freezing point and blood corpuscle methods, A., ii, 421.
- Hammarsten, *Olof*, detection of bile pigments in urine, A., ii, 637.
- Hampe, *W.* See *Karl Auwers*.
- Hanamann, *Joseph*, manurial experiments with barley, A., ii, 41.
- simplified method of estimating phosphoric acid by molybdate, A., ii, 311.
- manurial experiments, A., ii, 752.
- Hanamann, *Joseph*, and *Leopold Mourinsky*, hops and hop soils, A., ii, 163.
- Handy, *James Otis*, volumetric estimation of magnesia, A., ii, 314.
- Hanford, *G. A.*, influence of acids on the amylolytic action of saliva, A., ii, 666.
- Hanford, *G. A.* See also *Philip Embury Browning*.
- Hansen, *C.* See *V. Henriques*.
- Hantzsch, *Arthur [Rudolf]*, nitroso-alkylurethanes, A., i, 86.
- characterisation of weak acids and pseudo-acids, A., i, 94.
- normal diazo-compounds as "pseudo-diazonium compounds," A., i, 126.
- salts and bases of triphenylmethane dyes, A., i, 365.
- syndiazotates, A., i, 567.
- syndiazocyanides and diazonium cyanides, A., i, 567.
- nature of the diazohaloids, A., i, 568.
- history of the isonitro-compounds, A., i, 618.
- nomenclature of the diazo-compounds, A., i, 702.
- a new nitrogen iodide, N₂I, A., ii, 274.
- Hantzsch, *Arthur [Rudolf]*, and *J. W. Blagden*, interaction of diazonium salts with cuprous compounds, A., i, 704.
- Hantzsch, *Arthur [Rudolf]*, and *M. Kalb*, pseudo-ammonium bases, A., i, 113.
- cotarnine cyanide as a pseudo-salt, A., i, 557.
- Hantzsch, *Arthur [Rudolf]*, and *Hermann Kissel*, derivatives of nitroic acids and reactions of nitro-compounds, A., i, 89.
- Hantzsch, *Arthur [Rudolf]*, and *Gustav Osswald*, transformation of colour-bases into pseudo-ammonium hydroxides, cyanides, and sulphonic acids, A., i, 256.
- Hantzsch, *Arthur [Rudolf]*, [and in part with *Gustav Osswald*, *W. Semple*, and *J. Spear*], decomposition of diazonium salts, A., i, 703.
- Hantzsch, *Arthur [Rudolf]*, and *F. Sebaldt*, molecular state of ammonia and of amines in aqueous solutions, A., ii, 69.
- Hantzsch, *Arthur [Rudolf]*, and *Oswald Silberrad*, polymerisation products from ethyl diazoacetate, A., i, 261.
- Hantzsch, *Arthur [Rudolf]*, and *J. S. Smythe*, transformation of bromodiazonium chlorides into chlorodiazonium bromides, A., i, 315.
- Hantzsch, *Arthur [Rudolf]*. See also *Adalbert Engler*, and *Robert C. Farmer*.
- Hanuš, *Jos.*, hazel nut oil, A., ii, 101.
- rancidity of butter, A., ii, 634.
- estimation of aldehydes by means of hydrazines. I. Estimation of vanillin, A., ii, 773.

- Hannä, Jos., and Alb. Stocky**, chemical action of mould on butter, A., ii, 772.
- Hardin, D.**, reactions in which safranines are formed, A., i, 412.
- Hardin, Willett Lepley**, derivatives and atomic weight of palladium, A., ii, 85.
- Hardin, Willett Lepley**. See also *Edgar Francis Smith*.
- Harding, E.** See *Theodor Curtius*.
- Harding, E. P.** See *George Bell Frankforter*.
- Hardy, W. B.**, mechanism of gelation in reversible colloidal systems, A., ii, 396.
- Harker, G.**, estimation of nicotine; amount of nicotine in New South Wales tobaccos, A., ii, 778.
- Harkness, William**, obituary notice of, T., 592.
- Harlay, V.**, digestion of fibrin and albumin by papain, A., i, 419.
- action of heat on papain, A., i, 420.
- action of papain on pepsin and pancreatin, A., i, 468.
- proteolytic ferments of germinating seeds, A., ii, 744.
- Harms, Heinrich**, fluorine in tooth- and bone-ash, A., ii, 29.
- Harnack, Erich, and Else von der Leyen**, indicanuria produced by administration of oxalates, A., ii, 422.
- Harpe, B. von, and Stanislaus von Kostanecki**, 8:3'-dihydroxyflavone, A., i, 237.
- Harries, Carl D.**, citronellalacetal, A., i, 331.
- oxidation of the oximes of unsaturated compounds, A., i, 504.
- Harries, Carl D., and Ernst Klamt**, action of thiocyanacetic acid on phenylhydrazine, A., i, 413.
- Harries, Carl D., and Georg Roeder**, pulegone and isopulegone, A., i, 182.
- Harris, David Fraser**, pressure filtration of proteids, A., ii, 222.
- Harrison, J. Bristowe P.** See *Henry Droop Richmond*.
- Harrold, C. C.** See *Frederic S. Lee*.
- Hartleb, R.** See *Albert Stutzer*.
- Hartley, Ernald George Justinian**, pharmacosiderite, A., ii, 23.
- plumbogummite and hitchcockite, A., ii, 600.
- beudantite, A., ii, 601.
- Hartley, Walter Noel**, two hydrated cobalt oxides, green- and buff-coloured, P., 1899, 202.
- Hartley, Walter Noel, and James Johnstone Dobbie**, absorption spectra of ammonia, methylamine, hydroxylamine, aldoxime, and acetoxime, T., 318; P., 1900, 14.
- Hartley, Walter Noel, and James Johnstone Dobbie**, spectrographic studies in tautomerism: the absorption curves of the ethyl esters of dibenzoylsuccinic acid, T., 498; P., 1900, 57.
- the curves of the molecular vibrations of benzantialdoxime and benzsynaldoxime, T., 509; P., 1900, 58.
- ultra-violet absorption spectra of some closed chain carbon compounds. Part II. Dimethylpyrazine, hexamethylene, and tetrahydrobenzene, T., 846; P., 1900, 129.
- Hartley, Walter Noel, James Johnstone Dobbie, and Photios G. Paliatseas**, a study of the absorption spectra of o-oxy-carbanil and its alkyl derivatives in relation to tautomerism, T., 839; P., 1900, 130.
- Hartmann, Ludwig**. See *Muz Busch*.
- Hartong van Ark, H.** See *Ernst Schmidt*.
- Hart-Smith, James**. See *Martin Onslow Forster*.
- Hartwell, Burt L.** See *Homer J. Wheeler*.
- Hartwell, John B.** See *Philip Embury Browning*.
- Hartwich, C., and E. Dünneberger**, an alcornoco bark known commonly as jaborandi, and alcornoco barks in general, A., ii, 747.
- Harvey, Alfred William**. See *William Jackson Pope*.
- Hasselberg, H.**, spectra of metals in the electric arc. V. Spectrum of vanadium, A., ii, 381.
- Hauser, Otto, and Ludwig Vanino**, double salts of bismuth chloride with some organic bases, A., i, 641.
- Hauser, Otto**. See also *Ludwig Vanino*.
- Hausmann, Arthur**, *extractum filicis aethereum*, A., i, 49.
- Hausmann, Walther**, the condition of nitrogen in the proteid molecule, A., i, 317.
- Hausser, Jean**. See *Cathelineau*.
- Havens, Franke Stuart, and Arthur F. Way**, separation of iron from chromium, zirconium, and beryllium by the action of hydrogen chloride on the oxides, A., ii, 50.
- Hawk, P. B.** See *H. C. Sherman*.
- Hawthorn, John**. See *Edmund Albert Letts*.
- Haywood, John K.**, some boiling point curves, A., ii, 64.
- estimation of glycogen, and relative amounts of glycogen in different parts of the flesh of the horse, A., ii, 321.

- Haywood, John K.**, adulteration and analysis of arsenical insecticides, A., ii, 758.
- Hasewinkel, J. J.**, indican and its enzyme, A., i, 403.
- Hecker, G.** See *Franz Kunkell*.
- Hedin, Sven Gustav**, the influence of animal membranes on the diffusion of various substances, A., ii, 221.
- Hédon, E.**, absorption of sugars in the intestine, A., ii, 223.
- agglutination of blood corpuscles by chemical agents, A., ii, 665.
- Hédon, E.**, and **J. Arrous**, relations between the diuretic effects and osmotic properties of sugars, A., ii, 94.
- Heen, A. de**, transparency of various liquids to electric oscillations, A., ii, 524.
- Heffter, Arthur**, and **W. Feuerstein**, embelic acid, A., i, 498.
- Hegner, Otto**, boric acid and formaldehyde as food preservatives, A., ii, 561.
- Heiberg, Thv.** See *Charles Frederick Cross*.
- Heidenreich, Ole. N.**, estimation of sulphur in pyrites, A., ii, 310.
- Heim, C.**, [detection of] furfuraldehyde in beer, A., ii, 327.
- Heimrod, George W.** See *Theodore William Richards*.
- Heinemann, Adolf**, Ullmann's tests for tanning materials and basic colours used in dyeing, A., ii, 380.
- Heinrich, Gg.**, magnetic behaviour of alcohols, A., ii, 707.
- Heinrichs, Carl.** See *Max Busch*.
- Heinselmann, G.**, decomposition of diastase during fermentation, A., ii, 230.
- Helbig, Maximilian.** See *Richard Stoermer*.
- Held, Alfred**, apparatus for the estimation of carbon dioxide in mineral waters, A., ii, 169.
- Helfenstein, A.**, application of Faraday's law to the electrolysis of fused salts, A., ii, 383.
- Helfenstein, A.** See also *Richard Lorenz*.
- Helle, J.** See *Julius Bertram*.
- Hellsing, Gustaf**, chrysean, A., i, 518.
- Hellström, Paul**, action of animal manure on peat soil, A., ii, 616.
- Hellwig, Karl**, some complex silver salts, A., ii, 723.
- Hemmeter, John C.**, proteolytic and amylolytic ferments in the contents of the human colon, A., ii, 607.
- Hempel, Hans.** See *Adolf Beythien*.
- Hempel, Walther**, and **von Haasy**, preparation of amorphous silicon, silicon chloride, and thiosilicates, A., ii, 275.
- Hemptinne, Alexander de**, velocities of reaction, A., ii, 199.
- has magnetism an influence on chemical reactions? A., ii, 707.
- Henderson, W. Craig**, electrical effects due to evaporation of sodium in air and other gases, A., ii, 588.
- Henderson, Yandell**, the nitrogen which can be split off from proteids by acids, A., i, 265.
- hexon bases; lysine, A., i, 571.
- Henneberg, W.**, acetic bacteria, A., ii, 297.
- Henrich, Ferdinand**, constitution of nitroso-orcinol, A., i, 163.
- the negative nature of unsaturated groups of atoms, A., i, 429.
- nitroso-orcinol, A., i, 436.
- Henriques, Robert**, estimation of sulphur in organic substances, A., ii, 107.
- analysis of rubber wares, A., ii, 124.
- Henriques, Robert**, and **Otto Mayer**, estimation of total and free alkali and alkali carbonate in soaps, A., ii, 637.
- Henriques, V.**, and **C. Hansen**, formation of fat in the animal organism by intensive feeding of fat, A., ii, 668.
- Henry, Louis**, anisonitrile, A., i, 172.
- reactions of paraformaldehyde, A., i, 537.
- methyl ethyl ketone, A., i, 537.
- Hentschel, W.**, fusion of indigotin with potassium hydroxide, A., i, 231.
- Henze, Martin**, preparation of phenyl-indoxyl, A., i, 119.
- condensation of benzyl cyanide and ethyl fumarate, A., i, 347.
- Hepp, Eduard.** See *Otto Fischer*.
- Herberger, Th.** See *Alfred Werner*.
- Hérics-Tóth, E. von.** See *Tamas Kosutány*.
- Hering, Fr.** See *Oscar Kellner*.
- Hérissey, Henri**, reserve carbohydrate of the seed of *Trifolium repens*, A., ii, 561.
- Hérissey, Henri.** See also *Émile Bourquelot*.
- Herlant, Léon**, nucleic acids from various sources, A., i, 466.
- Hermes, Ulrich.** See *Richard Stoermer*.
- Herold, Willy.** See *Ludwig Wolff*.
- Herr.** See *Carl Adam Bischoff*.
- Herting, Otto**, estimation of carbon, copper, and manganese in iron, A., ii, 245.
- Hers, W.**, equilibrium between manganous salts and ammonia, A., ii, 68.
- equilibrium in the partition of an acid between zinc hydroxide and ammonia, A., ii, 337.

- Hers, W.**, equilibria in the partition of an acid between ammonia and sparingly soluble metallic hydroxides, A., ii, 532.
— aluminates, A., ii, 728.
- Hers, W.** See also *Richard Abegg*.
- Hersfeld, Alexander**, estimation of phosphoric acid soluble in a 2 per cent. solution of citric acid, A., ii, 243, 367.
- Hersig, Josef**, and *F. Aigner*, mono-alkyl ethers of phloroglucinol, A., i, 545.
- Hersig, Josef, Jacques Pollak**, and *Karl Rohm*, bromo-derivatives of the homologous phloroglucinols, A., i, 595.
- Hersig, Josef**, and *Franz Wenzel*, methyl phloroglucinolcarboxylate, A., i, 176.
- Hersog, Johannes**. See *Wilhelm Manchot*.
- Hess, William H.**, origin of nitrates in cavern earths, A., ii, 550.
— method for the gravimetric estimation of calcium, A., ii, 688.
- Hess, William H.**, and *Edward D. Campbell*, direct estimation of aluminium in presence of iron, manganese, calcium, and magnesium, A., ii, 50.
- Hess, William H.**, and *R. E. Doolittle*, detection of "process" or "renovated" butter, A., ii, 452.
- Hess, William H.** See also *R. E. Doolittle*.
- Hesse, Albert**, ethereal oil of jasmine flower, A., i, 48, 454.
- Hesse, Oswald**, pseudococotoin, A., i, 35.
— compounds of rhubarb, and allied substances, A., i, 40.
— alkaloids of the Solanaceæ, A., i, 50.
- Heteren, W. J. van**, nitrosyl chloride and its compounds, A., ii, 137.
- Hewitt, John Theodore**, preparation of benzeneazo-o-nitrophenol, T., 99; P., 1899, 229.
— relation between the constitution and fluorescence of some substances, P., 1900, 3; A., ii, 518.
- Hewitt, John Theodore**, and *William George Aston*, bromination of benzeneazophenol, I. and II., T., 712, 810; P., 1900, 89, 131.
- Hewitt, John Theodore**, and *Bryan W. Perkins*, contributions to the knowledge of fluorescent compounds. Part I. The nitro-derivatives of fluorescein, T., 1924; P., 1900, 178.
- Heycock, Charles Thomas**, and *Francis Henry Neville*, gold-aluminium alloys, A., ii, 549.
- Heyn, E.**, Osmond and Roberts-Austen's theory of iron-carbon alloys, A., ii, 657.
— iron and hydrogen, A., ii, 728.
- Heynsius, D.** See *Paul Duden*.
- Hibbert, H.** See *J. P. Millington*.
- Hiepe, E.** See *Alexander Tschirsch*.
- Higbee, Howard H.**, double halogen salts of antimony with aniline and the toluidines, A., i, 285.
- Higgin, Alfred J.**, melonite from South Australia, A., ii, 283.
- Hildburgh, W. L.**, new electrolytic cell for rectifying alternating currents, A., ii, 520.
- Hildburgh, W. L.** See also *J. Livingston R. Morgan*.
- Hildebrand, O.** See *Wilhelm Autenrieth*.
- Hildebrandt, Hermann**, syntheses in the animal organism. I. Piperidine derivatives, A., i, 686; ii, 676.
- Hilgard, Eugen W.**, [estimation of] free arsenious oxide in Paris green, A., ii, 758.
- Hilger, Albert**, colouring matter of saffron, A., i, 682.
— estimation of malic acid, A., ii, 768.
- Hilger, Albert**, and *W. E. Dreyfus*, gum tragacanth, A., i, 379.
- Hill, Adolf**. See *Eugen Bamberger*.
- Hill, Edwin A.**, system of indexing chemical literature; adopted by the Classification Division of the U.S. Patent Office, A., ii, 648.
- Hill, Henry Barker**, 2:6-diphenyl-4-nitrophenol and 2-phenyl-4-nitrophenol, A., i, 92.
- Hill, Henry Barker, Charles A. Soch**, and *George Oenslager*, condensation of nitromalonic aldehyde with ketones and ketonic acids, A., i, 538.
- Hill, J. Rutherford**, strychnine salts and chloroform, A., ii, 455.
- Hillebrand, William Francis**, melonite (?), coloradoite (?), petzite, and hesite, A., ii, 22.
- Hillebrand, William Francis**, and *F. Leslie Ransome*, carnotite and associated vanadiferous minerals in W. Colorado, A., ii, 599.
- Hillebrand, William Francis**, and *Henry N. Stokes*, relative values of the Mitscherlich and hydrofluoric acid methods for the estimation of ferrous iron, A., ii, 763.
- Hillebrand, William Francis**. See also *William Albert Noyes*.
- Hills, Josef Lawrence**, effect of food on the quality of butter, A., ii, 236, 568.
— effect of fatigue on the quantity and quality of milk, A., ii, 567.

- Hofmann, A.**, rôle of iron in blood formation, A., ii, 491.
- Hofmann, Karl A.**, pentacyano-iron compounds, A., i, 591.
- Hofmann, Karl A.** [and in part *W. Bosch, E. Eichwald, and Julius Sand*], mercarbide, $C_2H_2O_4Hg_2$, A., i, 383.
- Hofmann, Karl A.**, and **Eduard C. Marburg**, mercury derivatives of nitrogen compounds, A., ii, 279.
- Hofmann, Karl A.**, and **Julius Sand**, behaviour of mercuric salts towards olefines, A., i, 384.
- compounds of ethylene and allyl alcohol with mercuric salts, A., i, 618.
- Hofmann, Karl A.** See also **Julius Sand**.
- Hoitsema, C.**, stability of gun-cotton and smokeless powder, A., ii, 55.
- Hoitsema, C.** See also **Jacobus Martinus van Bemmelen**.
- Holdenleiss, Friedrich**, influence of fermentation on the value of hay, A., ii, 238.
- storage of stable manure, A., ii, 571.
- Holland, Philip**, and **Edmund Dickson**, analyses of glacial deposits and waters, A., ii, 151.
- Holland, Philip**. See also **T. Mellard Reade**.
- Holland, Auguste**, new electrodes for electrolytic estimations, A., ii, 435.
- analysis of commercial copper, A., ii, 442.
- Holland, Auguste**, and **L. Bertiaux**, estimation of arsenic in metals and alloys, A., ii, 438.
- Holleman, Arnold Frederik**, formation of trisubstituted from disubstituted benzene derivatives, A., i, 387.
- spontaneous decomposition of thio-sulphuric acid, A., ii, 478.
- Holleman, Arnold Frederik**, and **B. R. de Bruyn**, nitration of nitrobenzene, A., i, 481.
- simultaneous formation of isomeric substitution products of benzene, A., i, 638.
- Hollis, Fred S.**, *s-p*-nitro-*o*-sulphobenzoic chloride, A., i, 292.
- Holste, G.**, liquid carbon dioxide, A., ii, 623.
- Holtsmann, H.** See **Max Busch**.
- Hoogewerff, Sebastian**, and **H. ter Meulen**, indican, A., i, 404.
- Hopkins, Arthur John**, a dissolver, A., ii, 71.
- Hopkins, F. Gowland**, preparation of pure albumin from white of egg, A., i, 466.
- Hoppe, Paul**, value of molasses as food, A., ii, 681.
- Horn, D. W.** See **Harmon N. Morse**.
- Hornberger, Richard**, distribution of ash constituents in the section of the copper beech, A., ii, 496.
- Hornbostel, Erich von**, and **Eduard O. Siebner**, condensation of glyoxal and isobutaldehyde, A., i, 206.
- Horsfall, Louis Hubert**. See **Arthur George Perkin**.
- Horst, A. ter**. See **M. van Breukelen**.
- Hoosking, R.**, viscosity of solutions, A., ii, 386.
- Hotter, Eduard**, material for plant nutrition in apples and pears, A., ii, 745.
- Houben, Joseph**, apparatus for melting point determinations, A., ii, 645.
- Hougardy**, albumin in ox-serum, A., i, 709.
- Houghton, E. M.** See **T. B. Aldrich**.
- Howell, William H.**, use of alkaline solutions in surgical shock, A., ii, 558.
- Howells, Vincent Allen**. See **Conrad Willgerodt**.
- Howles, Fred H.**, **Jocelyn Field Thorpe**, **William Udall**, and in part **H. A. Neale**, β -isopropylglutaric acid and *cis*- and *trans*-methylisopropylglutaric acids, T., 942; P., 1900, 115.
- Howles, Fred H.** See also **Arthur McDougall**.
- Hoyer, E.** See **Carl Liebermann**.
- Hubert, L.** See **Aug. Fernbach**.
- Hudson, Edward J.** See **Charles Frederic Mabery**.
- Hüfner, [Carl] Gustav**, formation of methæmoglobin, A., i, 267.
- simultaneous estimation of two colouring matters in blood by the spectrophotometer, A., ii, 459.
- Hüts, Hugo**. See **Alfred Einhorn**.
- Hugershoff, A.**, acyl derivatives of the aromatic thiocarbamides; their isomerism and constitution, A., i, 155.
- Hughes, Frank**. See **Thomas Southall Dymond**.
- Hugot, Charles**, action of potassammonium on arsenic, A., ii, 14.
- nitrogen iodide, A., ii, 274.
- Hugounenq, Louis**, fixation of alkaline bases in the foetal body during the last five months of intrauterine life, A., ii, 418.
- mineral statics of the human foetus during the last five months of intrauterine life, A., ii, 490.
- Hulett, George Aug.**, calibration of glass tubes, and some compressibility experiments, A., ii, 397.

- Hulett, George Aug.**, distillation of amalgams and the purification of mercury, A., ii, 543.
- Hummel, John A.**, examination of Brown and Taylor's official method of identifying butter, A., ii, 582.
- Hunt, R.**, a depressor substance in the suprarenal gland, A., ii, 295.
- Huppert, Karl Hugo.** See **Emil Schütz**.
- Hurlon, A.** See **F. Parmentier**.
- Hurtley, W. H.** See **Frederick Daniel Chataway**.
- Hussak, Eugen**, and **George Thurland Prior**, florencite, a new mineral from Brazil, A., ii, 601.
- Hutchins, George P.** See **Philip Embury Browning**.
- Hutchinson, Arthur**, stokesite, a new mineral from Cornwall, A., ii, 89, 603.
- Huyse, A. C.**, microchemical detection of potassium, rubidium, caesium, indium, and thiosulphates, A., ii, 245.
- Hyde, Henry St. John.** See **H. C. Sherman**.

I.

- Ibbotson, Fred**, and **Harry Brearley**, rapid evaluation of metallic tungsten powders, A., ii, 816.
- analysis of tungsten compounds, A., ii, 817.
- separation of tungsten and molybdenum, A., ii, 445.
- estimation of phosphorus in steel, etc., A., ii, 757.
- estimation of molybdenum in steel and steel-making alloys, A., ii, 766.
- Iggens, H.** See **Wilhelm Kerp**.
- Iglauer, Fritz.** See **Richard Willstätter**.
- Ikeda, Kikunaye**, deduction of reaction isotherms and isochors for systems involving dissociation, A., ii, 886.
- simple proof of van't Hoff's osmotic pressure law, A., ii, 391.
- Ilosvay de Nagy Ilosva, Ludwig**, ammoniacal copper solutions and hydroxylamine as a test for acetylene, A., ii, 52.
- Imbert, Henri**, heat of neutralisation and acidimetry of cacodylic acid, A., i, 145.
- Imbert, Henri**, and **A. Astruc**, acidimetry, A., i, 226.
- volumetric estimation of sodium cacodylate, A., ii, 122.
- Imbert, Henri**, and **E. Badel**, elimination of sodium cacodylate in the urine after administration by the stomach, A., ii, 293.
- Imbert, Henri**, and **Guillaume Beigou**, velocity and limits of the esterification of phosphoric acid, A., i, 130.
- Immendorff, Heinrich**, amounts of plant food withdrawn from peaty and sandy soil by cutting heather and turf, A., ii, 104.
- composition of *Molinia caerulea* and *Carex Goodenowii*, A., ii, 162.
- composition of green manure grown in peaty and sandy soils, A., ii, 164.
- Immendorff, Heinrich**, and **Bruno Tacke**, vegetation experiments with various peat soils, A., ii, 615.
- Immendorff, Heinrich.** See also **Bruno Tacke**.
- Immerwahr, Cl.**, potentials of copper electrodes in solutions; copper precipitates of importance in analysis, A., ii, 642.
- Immerwahr, Cl.** See also **Richard Abegg**.
- Impens, E.**, physiological action of morphine and its allies, A., ii, 228.
- Imrie, John.** See **Edmund James Mills**.
- Indemans, W. G.**, butter and butter substitutes, A., ii, 115.
- Ipatieff, Wladimir** (and in part **A. Solonina**), nitrosates, A., i, 3.
- action of nitrosyl chloride on organic compounds containing a double linking, A., i, 14.
- Ipsen, Karl**, chemical detection of carbonic oxide in blood, A., ii, 169.
- Isachenko, B.**, influence of metals on broth-cultures of Bacteria, A., ii, 230.
- Isherwood, Percy C. C.** See **Henry Edward Armstrong**.
- Istrati, Constantin I.**, detection of aldehydes in alcohols, A., ii, 117.
- Ittner, Martin H.**, modification of the water vacuum pump, A., ii, 718.
- Itzig, Hermann.** See **Arthur Rosenheim**.
- Iwasaki, C.**, augite from Yoneyama, Japan, A., ii, 286.

J.

- Jaboin, A.**, preparation and properties of crystallised barium and strontium phosphides, A., ii, 76.
- Jackson, Charles Loring**, and **I. H. Derby**, ferrous iodide, A., ii, 596.
- Jackson, Charles Loring**, and **R. W. Fuller**, constitution of di-*p*-bromobenzylecyanamide, A., i, 482.
- Jackson, Charles Loring**, and **F. H. Gaxsole**, certain coloured substances derived from nitro-compounds, A., i, 433.
- Jackson, Henry**, formation of α - and β -acrose from glycollic aldehyde, T., 129; P., 1899, 238.

- Jackson, Henry.** See also *Richard H. Solly*.
- Jackson, Holmes C.** phosphorus in paraneuclein from casein, A., ii, 606.
- Jackson, Holmes C.** See also *Lafayette B. Mendel*.
- Jacobson, Paul, and Arthur Loeb,** pentabromobenzene, A., i, 281.
- Jacoby, Martin,** aldehydase from the liver and suprarenal capsule, A., i, 711.
- fermentative decomposition of proteid, and ammonia-formation in the liver: changes in the liver during phosphorus poisoning, and their relation to autolysis, A., ii, 671.
- Jacoby, Richard.** See *Richard Jos. Meyer*.
- Jaekel, Bernhard.** See *Robert Pschorr*.
- Jaeger, Wilhelm, and St. Lindeck,** the Weston cell, A., ii, 703.
- Jaffa, Mejer E.,** composition and food-value of the salt bushes, A., ii, 569.
- Jaffé, Adolf.** See *Frederic W. Richardson*.
- Jagelki, Wilhelm.** See *Julius Bredt*.
- Jahn, Hans,** degree of dissociation and dissociation equilibrium of highly dissociated electrolytes, A., ii, 522, 707.
- Jandrier, Edmond,** colour test for the detection of methyl alcohol, A., ii, 52.
- chemical detection of vegetable fibres, A., ii, 177.
- Jannasch, Paul [Ehrhard], and K. Biedermann,** precipitation and separation of copper in the presence of sodium hydroxide by the aid of hydrazine sulphate or hydrochloride, A., ii, 315.
- Japp, Francis Robert, and James Moir,** constitution of amarine, of its supposed dialkyl- and diacyl-derivatives, and of isamarine, T., 608; P., 1899, 211, 227; 1900, 15.
- Jaubert, George F.,** naphthapurpurin (trihydroxy- α -naphthaquinone), A., i, 42.
- preparation of naphthalic acid, A., i, 296.
- diazotisation of safranine, A., i, 315.
- Javorsky, W. P.** See *Jakov I. Michailenko*.
- Jean, Ferdinand,** determination of the melting point of fats, A., ii, 179.
- qualitative analysis of the ammonium sulphide group, A., ii, 619.
- estimation of tannic and gallic acids, A., ii, 632.
- estimation of glycerol in fats and soaps, A., ii, 694.
- estimation of lactic acid in the commercial article, A., ii, 767.
- Jeaneard, Paul, and Satie,** essence of geranium, A., i, 242.
- — — essential oil of jasmine, A., i, 510.
- — — essential oil of lavender and the causes of the variation in the amount of esters contained in it, A., i, 510.
- — — essential oils of neroli and petit-grain, A., i, 511.
- Jebenko, A.** See *Michael I. Konowaloff*.
- Jellinek, S., and Fr. Schiffer,** comparative determinations of the specific gravity, dry residue, and amount of iron in blood, A., ii, 152.
- Jenkins, Edward H.,** observations on the growth of maize continuously for nine years, A., ii, 41.
- experiments with tobacco fertilisers, 1892—1896, A., ii, 239.
- effect of fertilisers on the composition of wrapper leaf tobacco, A., ii, 239.
- Jenkins, Edward H., and W. E. Britton,** use of commercial fertilisers for forcing house crops, A., ii, 365.
- Jenkins, Edward H.** See also *Samuel William Johnson*.
- Jennings, Herbert S.,** reactions to stimuli in unicellular organisms, A., ii, 158, 425.
- Jensen, Hjalmar,** denitrification Bacteria and sugar, A., ii, 232.
- morphology and biology of denitrifying Bacteria, A., ii, 495.
- Jensen, Hjalmar.** See also *Albert Stutzer*.
- Jentschmen.** See *Carl Adam Bischoff*.
- Jereméeff, Pavel V. von,** cerussite from the Altai, A., ii, 354.
- pseudomorphs after olivine from the Urals, A., ii, 354.
- laeur-oligocase from Lake Baikal, A., ii, 603.
- Jervis, Horace,** estimation of manganese in steel, A., ii, 444.
- Jessen-Hansen, H.,** estimation of invert sugar in the presence of sucrose, A., ii, 113.
- Jesser, Leopold,** determination of the inverting power of raw sugar, A., i, 276.
- Jimbō, Kotora,** minerals of Japan, A., ii, 87.
- Job, André,** apparatus for measuring evolved gases at constant volume, A., ii, 434.
- oxidation of salts of cobalt and of cerium in alkaline solution, A., ii, 657.
- Jørgensen, Gunner,** iodometric experiments, A., ii, 620.

- Jørgensen, Sofus Mads**, constitution of platinum bases, A., i, 542.
- Johannsen, Wilhelm** [*Ludwig*], relation between the weight and the percentage of nitrogen in barley grain, A., ii, 363.
- John, Conrad Heinrich von**, eruptive rocks from the Salzkammergut, A., ii, 219.
- Johnson, Samuel William, Edward H. Jenkins, and W. E. Britton**, availability of fertiliser-nitrogen, A., ii, 42, 506.
- Johnson, Treat B.** See *Henry Loré Wheeler*.
- Jolles, Adolf**, the phosphometer, an apparatus for the clinical estimation of phosphorus in blood, A., ii, 311.
- action of iodine solution and alkaline permanganate on uric acid, A., ii, 322.
- estimation of uric acid in urine, A., ii, 450.
- a quantitative reaction of ureides and purine derivatives, A., ii, 454, 636.
- estimation of urea in urine, A., ii, 515.
- detection of albumin in urine, A., ii, 516.
- quick and exact test for mercury in urine, A., ii, 576.
- precipitation of uric acid by barium chloride, A., ii, 696.
- Jones, Edward William Taylor**, treacle or golden syrup, A., ii, 447.
- Jones, Harry Clary**, electrolytic dissociation of certain salts in methyl and ethyl alcohols, as measured by the boiling point method, A., ii, 187.
- Jones, Harry Clary, and Victor J. Chambers**, abnormal depressions of the freezing point produced by chlorides and bromides of the alkaline earths, A., ii, 262.
- Jones, Harry Clary, and Arthur W. Smith**, solution tension of zinc in ethyl alcohol, A., ii, 467.
- Jones, Humphrey Owen.** See *Henry John Horstman Fenton*.
- Jones, Louis Cleeland**, iodometric method for the estimation of boric acid, A., ii, 47.
- Jones, Walter**, thymine, A., i, 319, 572.
- Jones, William App**, dicarbonyl cuprous chloride, A., ii, 17.
- Jorissen, W. P., and Lodewyk Theodorus Reicher**, influence of catalytic agents on the oxidation of oxalic acid solutions, A., ii, 200.
- Jorre, F.** See *Fritz Foerster*.
- Journiaux**, reversible reaction between hydrogen chloride and silver, A., ii, 139.
- Jouve, Adolphe.** See *L. Léon A. Prunier*.
- Jowett, Hooper Albert Dickinson**, pilocarpine and the alkaloids of jaborandi leaves, T., 473; P., 1900, 49; discussion, P., 50.
- new glucoside from willow bark, T., 707; P., 1900, 89.
- constitution of pilocarpine, T., 851; P., 1900, 123; A., i, 636.
- Juckenack, Adolf**, composition of hens' eggs, A., ii, 290.
- examination and valuation of commercial pastry, A., ii, 460.
- Jung, W. L.** See *Schumacher*.
- Junghahn, Alfred**, sulphonic acids of the acetylxylinidines, A., i, 389.
- Junghahn, Alfred, and Max Neumann**, aminoazobenzenetrisulphonic acid, A., i, 418.

K

- Kacer, F.** See *Roland Scholl*.
- Kahlbaum, Georg W. A.**, melting point of lithium, A., ii, 277.
- Kahlenberg, Louis**, preparation of metallic lithium, A., ii, 206.
- relation of the taste of acid salts to their degree of dissociation, A., ii, 270, 646.
- electrolytic deposition of metals from non-aqueous solutions, A., ii, 521.
- Kahlenberg, Louis, and Rollan M. Austin**, toxic action of acid sodium salts on *Lupinus albus*, A., ii, 747.
- Kalb, M.** See *Arthur Hantersch*.
- Kalkow, Fritz.** See *Daniel Vorländer*.
- Kanonnikoff, Innocentius I.**, true density of chemical compounds and its relation to composition and constitution, A., ii, 134.
- Kasanezsky, P.** See *Pavel I. Petrenko-Kritschenko*.
- Kasanezsky, Alexander**, action of hydrogen bromide on ricinoleic acid and on its acetyl derivatives, A., i, 426.
- Kassatkin, N.** See *Jacobus Henricus van't Hoff*.
- Kassner, Georg**, orthoplumbates of the alkaline earths. IV. Lead "peroxide," A., ii, 725.
- Kastle, J. H.**, effect of very low temperatures on the colour of compounds of bromine and iodine, A., ii, 526.
- Kastle, J. H., and L. O. Beatty**, supposed allotropism of phosphorus pentabromide, A., ii, 538.
- Kastle, J. H., and W. A. Beatty**, effect of oxidising agents on the reduction of mercuric chloride by oxalic acid, A., ii, 627.

- Kastle, J. H.**, and *Mary E. Clark*, effect of various solvents on the allotropic change of mercuric iodide, A., ii, 141.
- Katsuyama, K.**, *T. Kuwahara*, and *K. Seno*, influence of theine on the excretion of alkalis, A., ii, 94.
- Kattein, A.** See *Hermann Rodewald*.
- Katz, E.** See *Fritz Fichter*.
- Katz, Julius**, estimation of santonin, A., ii, 583.
- Katzer, Friedrich**, manganese ore from the Amazon district, A., ii, 733.
- Kauffmann, Hugo**, ring-system of benzene, A., i, 480.
- the number of isomeric naphthalene derivatives, A., i, 544.
- Kay, Sydney A.**, equilibrium between sulphuric acid and sulphates in aqueous solution, A., ii, 198.
- Kebler, Lyman F.**, wood tar creosote, A., ii, 176.
- Kedesdy, Erich.** See *Heinrich Biltz*.
- Kehrmann, Friedrich**, and *P. Filatoff*, the eighth and ninth isomerides of rosinduline, A., i, 60.
- Kehrmann, Friedrich**, and *Zenaide Kikine*, nitro- and amino-flavindulines, A., i, 61.
- Kehrmann, Friedrich** [with *Kramer, L. Schild*, and *P. Thomas*], constitution of oxazine dyes, and quadrivalent oxygen, A., i, 61.
- Kehrmann, Friedrich** [with in part *O. Krüger*, and *M. Schoen*], stereochemistry of quinoneoximes, A., i, 180.
- Kehrmann, Friedrich**, and *E. Büttmann*, complex inorganic acids. VIII. Arsenoduodecitungstic and arsenoluteotungstic acids, A., ii, 145.
- Kehrmann, Friedrich** [and in part *M. Stoffel*, and *Ch. Valencien*], wandering of the orthoquinonoid double linking in azonium compounds, A., i, 254.
- Kehrmann, Friedrich**, and *H. Wolff*, 7-acetyl-amino- β -naphthaquinone, A., i, 449.
- the tenth and eleventh isomerides of rosinduline, A., i, 463.
- Kellhofer, W.**, distribution of sugar, acid, and tannin in peas, A., ii, 497.
- Keller, Arthur**, organic phosphorus compounds in infants' urine, A., ii, 293.
- Keller, Edward**, selenium and tellurium, A., ii, 573.
- Kellner, Oscar, Fr. Hering**, and *O. Zahn*, König's process for the estimation of crude fibre free from pentosan, A., ii, 250.
- Kellner, Oscar**, and *A. Köhler*, metabolism in full-grown bullocks with maintenance and fattening foods, A., ii, 563.
- Kellner, Oscar, A. Köhler, F. Barnstein, W. Zielstorff, R. Ewert**, and *K. Wedemeyer*, influence of asparagine and ammonia on proteid metabolism in Ruminants, A., ii, 417.
- Kellner Oscar, A. Köhler, F. Barnstein, W. Zielstorff, H. Lührig**, and *F. Mach*, experiments with gluten and starch meal, A., ii, 565.
- Kellner, Oscar, A. Köhler, M. Lehmann, Fr. Hering, K. Wedemeyer**, and *Th. Methner*, experiments with meadow hay, oat straw, starch meal, and molasses, A., ii, 566.
- Kellner, Oscar, A. Köhler, M. Lehmann, Fr. Hering, K. Wedemeyer, J. Volhard, H. Peters, H. von Gillern**, and *O. Zahn*, experiments with meadow hay, wheat straw, starch meal, extracted rye straw, and molasses, A., ii, 566.
- Kellner, Oscar, A. Köhler, W. Zielstorff, Fr. Hering, R. Ewert**, and *M. Lehmann*, experiments with gluten, starch meal, and oil, A., ii, 565.
- Kellner, Oscar, H. Peters, O. Zahn**, and *A. Strigel*, beet molasses of different origin, A., ii, 566.
- Kemp, George T.**, and (*Miss*) *S. L. Dewey*, action on the heart of toxic products of the typhoid bacillus, A., ii, 559.
- Kemp, James F.**, titaniferous magnetites, A., ii, 283.
- Kendrick, Arthur**, migration constant of sulphuric acid, A., ii, 643.
- Kenrick, Frank B.** See *William Lash Miller*.
- Keppeler, Gustav.** See *Heinrich Goldschmidt*.
- Kerp, Wilhelm**, Baudouin's reaction, A., ii, 116.
- Kerp, Wilhelm**, and *Wilhelm Böttger*, [and in part *H. Winter* and *H. Iggena*], amalgams, A., ii, 656.
- Kerschbaum, Max**, the aldehydic constituents of oil of verbena; verbenone, A., i, 353.
- Kerschbaum, Max.** See also *Ferdinand Tiemann*.
- Kershaw, J. B. C.** See *Julius Brecht*.
- Kijner, Nic. M.**, action of silver oxide and of hydroxylamine on bromoamines, A., i, 277, 333.
- action of silver oxide on bromoamines with tertiary amino-groups, A., i, 629.
- Kikine, Zenaide.** See *Friedrich Kehrmann*.
- Kinch, Edward**, amount of chlorine in rain water collected at Cirencester, T., 1271; P., 1900, 183.

- Kinnicut, Leonard P.**, and **George R. Sanford**, iodometric estimation of small quantities of carbon monoxide, A., ii, 314.
- Kinsely**. See **Stone**.
- Kippenberger, Carl**, estimation of chloral hydrate and chloroform in toxicological analysis, A., ii, 581.
- estimation of alkaloids by means of a titrated solution of iodine, A., ii, 583.
- volumetric estimation of vegetable alkaloids by titration with acids, A., ii, 637.
- action of iodine on aconitine and caffeine, A., ii, 777.
- Kipping, Frederic Stanley**, isomeric partially racemic salts containing quinquevalent nitrogen. Parts I.—VI. Hydrindamine bromo- and chloro-camphorsulphonates, and *cis- α* -camphanates, T., 861; P., 1900, 51.
- note on the decomposition of semicarbazones, P., 1900, 63.
- Kipping, Frederic Stanley**, and **Harold Hall**, new syntheses of indene, T., 467; P., 1900, 54.
- Kipping, Frederic Stanley**, and **Harold Peters**, iodonium compounds of the type $IR^I R^{II} R^{III}$ and the configuration of the iodine atom, P., 1900, 62.
- Kirchmann, Joseph**, proteid metabolism during gelatin-feeding, A., ii, 669.
- Kirpal, Alfred**, alkyl salts of quinolinic and cinchomeronic acids, A., i, 51.
- Kisliansky**. See **Carl Adam Bischoff**.
- Kissel, Fritz**. See **Richard Stoermer**.
- Kissel, Hermann**. See **Arthur Hantzsch**.
- Kissel, J.**, reaction of nitrous esters with alcohols and ketones in presence of excess of hydrogen chloride [in alcoholic solutions], A., i, 620.
- Kisseloff, M. G.** See **Wetschislav E. Tietschenko**.
- Kissling, Richard**, chemistry of tobacco, A., ii, 640.
- Klages, August**, pulegone and methylhexanone, A., i, 44.
- conversion of dihydrocarvone into carvenone by means of formic acid, A., i, 239.
- Klages, August**, and **A. Kraith**, the carvone series, A., i, 42.
- Klages, August**, and **C. Liecke**, law governing the elimination of halogens from the benzene ring, A., i, 387.
- Klamt, Ernst**. See **Carl D. Harries**.
- Klapproth, W.** See **Hermann Ost**.
- Klason, Peter**, ethereal oil of fir wood (*Pinus Abies*, L.), A., i, 676.
- Klaudy, Josef**, and **Isidor Fink**, new aromatic hydrocarbon, $C_{24}H_{18}$, from mineral oil, A., i, 284.
- Kleiber, Albert**, estimation of cell-wall constituents, hemicelluloses, and cellulose in some plants and parts of plants, A., ii, 630.
- Klein, O. H.**, and **Stephen Farnum Peckham**, cement testing, A., ii, 627.
- Klein, Otto**, changes in expressed olives when stored under different conditions, A., ii, 615.
- Klemm, W.** See **Wilhelm Marekwald**.
- Klett, A.**, albumin in the cell of the queen bee, A., ii, 93.
- detection of salicylic acid in presence of citric acid, A., ii, 770.
- detection of indican in pathological urine, A., ii, 776.
- Kley, P.**, crystalline formation of indigotin, A., i, 346.
- Klien, R.** See **Alfred Werner**.
- Klimenko, Boris**. See **Simcon M. Tanatar**.
- Klimmer, Martia**, Lillienfeld's synthesis of peptone, A., i, 72.
- Kling, André**, biochemical oxidation of propylene glycol, A., i, 129.
- Klobb, [Constant] Timothée**, action of phenylcarbimide and aniline on γ -ketonic acids, A., i, 405.
- synthesis of β -benzoyl- α -methylpropionic (phenylmethylbutanonoic) acid, A., i, 497.
- Klobbie, Eduard August**. See **Jacobus Martinus van Bemmelen**.
- Klöcker, Albert**, is the formation of enzymes a trustworthy characteristic of yeasts? A., ii, 743.
- Klöpfer**, top dressing experiments with ammonium sulphate and sodium nitrate, A., ii, 616.
- Kloos, Johan H.**, cinnabar-bearing trachyte-tuff from South Tuscany, A., ii, 733.
- Klostermann, Max**, anagyrine, A., i, 515.
- Knierim, Woldemar von**, value of various concentrated foods, A., ii, 39.
- rye as food, A., ii, 748.
- vetch corn as food, A., ii, 749.
- Knöpfelmacher, Heinrich**. See **Hugo Ditz**.
- Knöpfer, Gustav**. See **Guido Goldschmiedt**.
- Knoevenagel, Emil**, Thiele's theory of partial valencies in the light of stereochemistry, A., ii, 534.
- Knorr, Eduard**. See **Wilhelm Koenigs**.
- Knorr, Ludwig**, preparation of acetylacetone, A., i, 376.
- Knorre, Georg von**, estimation of cerium, A., ii, 576.
- metaphosphates, A., ii, 651.
- Knorre, Georg von**, and **Kurt Arndt**, oxidation of hydroxylamine, A., ii, 204.

- Kneuppel, Chr. A.**, 6-aminoquinoline and its derivatives, A., i, 187.
- Kobert, Rudolf**, recognition of morphine and its derivatives, A., ii, 121.
- fungus poisons which decompose blood, A., ii, 156.
- Kobrak, Erwin**, caseinogen of human milk, A., ii, 420.
- Koch**. See *Carl Adam Bischoff*.
- Köhler, A.** See *Oscar Kellner*.
- Koelichen, Karl**, chemical dynamics of the condensation of acetone, A., ii, 395.
- Kölle, Martin**, invertin, A., i, 572.
- Kölle, Martin**. See also *William Küster*.
- König, [Franz] Josef**, connection between the chlorides and nitrates in polluted well waters in inhabited localities, A., ii, 438.
- the unrestricted use of starch syrup in articles of food, A., ii, 448.
- [estimation of cellulose], A., ii, 449.
- Koenig, Georg August**, economical constant gas generator, A., ii, 718.
- Koenigs, Wilhelm**, action of aldehydes on quinoline derivatives containing a methyl or methylene group in position 2 or 4, A., i, 189.
- conversion of cinchona alkaloids into derivatives of 4-phenylquinoline, A., i, 245.
- tetrahydroquinolyl-2-propionic acid, A., i, 250.
- Koenigs, Wilhelm**, and *Eduard Knorr*, derivatives of dextrose, A., i, 588.
- Königsberger, Joh.**, magnetic susceptibility, A., ii, 258.
- Köppen, O.** See *Rudolph F. Weinland*.
- Koert, W.**, phosphorite [from North Germany], A., ii, 734.
- Kösters, Wilhelm**, electrical charges of freshly prepared gases from electrolytic sources, A., ii, 4.
- Koettwitz, C.** See *Daniel Vorländer*.
- Köts, Arthur**, reactivity of the hydrogen atoms in disulphones, trisulphones, and tetrasulphones, A., i, 369.
- Köts, Arthur** [with *Sevin*], xylene hydrosulphides, A., i, 343.
- Kohlhammer, Erich**. See *Adolf Pinner*.
- Kohlrausch, Friedrich**, hydrolysis of some chlorine compounds of platinum, gold, and tin on standing, and under the influence of light, A., ii, 408.
- a model to show ionic mobility, A., ii, 712.
- Kohlrausch, Friedrich**, and *Margaret E. Maltby*, electrical conductivity of alkali chlorides and nitrates, A., ii, 61.
- Kohlschütter, Volkmar**, compounds of uranic acid with sulphurous acid, A., ii, 484.
- Kohn, Leopold**, action of potassium cyanide on aliphatic aldehydes, A., i, 205.
- molecular weight of the aldols, A., i, 274.
- Kohn, Leopold**. See also *Otto Bleier* and *Adolf Franke*.
- Köhner, E.**, brilliant-fast-red-G., A., i, 455.
- Köhner, Emil**, synthetical preparation of iretol and allied phenetrol derivatives, A., i, 224.
- Kolkwitz, R.**, soil bacteria, A., ii, 233.
- influence of light on the respiration of lower Fungi, A., ii, 361.
- Komppa, Gustav**, constitution of saturated dicarboxylic acids, A., i, 201.
- Kondakoff, Ivan L.**, constituents of *Flores Kosso*, A., ii, 38.
- Kondakoff, Ivan L.**, and *Eugen Lutschinin*, isomerism in the menthol series, A., i, 104, 604.
- Kondakoff, Ivan L.**, and *N. Schatz*, kossin or taenini of Pavesi and Vée, A., ii, 38.
- Kondakoff, Ivan L.**, and *Iwan Schindelmeyer*, syntheses in the terpene series, A., i, 508.
- Konowaloff, Dmitri P.**, relations between ammonia and salts in aqueous solutions, A., ii, 265.
- Konowaloff, Michael I.**, salts of nitro-compounds with nitrated bases; separations of nitro-compounds of different types, A., i, 324.
- preparation of camphene and menthene from the corresponding alcohols, A., i, 352.
- Konowaloff, Michael I.** [with *A. Jebenko*, and *S. Kotsina*], nitration of menthane and of triethylmethane, A., i, 324.
- Konowaloff, Michael I.**, and *W. Plotnikoff*, compounds of aluminium haloid salts with organic and inorganic substances, II., A., i, 323.
- Konya, Karl**, derivatives of 2-methyl-1:3:4:5-phenetrol, A., i, 545.
- Kossel, Albrecht** [with *Carl Ludwig Martin Leonhard*], and *Motonosuke Goto*, solution of uric acid by means of nucleic acid, A., ii, 421.
- Kossel, Albrecht**, and *Fr. Kutscher*, histidine, A., i, 71.
- proteids, A., i, 466.
- Kossel, Albrecht**. See also *H. Stendel*.
- Kostanecki, Stanislaus von**, oximes of some flavanones, A., i, 449.
- Kostanecki, Stanislaus von**, and *W. Feuerstein*, brazilin, A., i, 355.

- Kostanecki, Stanislaus von**, and *Th. Schmidt*, 2:3':4'-trihydroxyflavone, A., i, 238.
- Kostanecki, Stanislaus von**, and *A. Seifart*, 2:2'-dihydroxyflavone, A., i, 668.
- Kostanecki, Stanislaus von**, and *Josef Tambor*, [with *J. Bongarts*], formation of flavone from its decomposition products, A., i, 239.
- Kostanecki, Stanislaus von**. See also *M. Bloch*, *J. Blumstein*, *C. Crivelli*, *J. Czajkowski*, *S. Grossmann*, and *B. von Harpe*.
- Kosutány, Tamas**, *Richard Windisch*, *E. von Hérics-Tóth*, *Ladislav von Štáll*, and *Adolf Faltin*, beans, A., ii, 750.
- Kotsina, S.** See *Michael I. Konowaloff*.
- Kourinsky, Leopold**, composition of some manure-soils, A., ii, 752.
- Kourinsky, Leopold**. See also *Joseph Hanamann*.
- Kovář, František**, analysis of Moravian minerals, A., ii, 147, 148, 149.
- Kovář, Johann**, estimation of sugar in beet, A., ii, 694.
- Kowalewsky, Wl. von**, stannic chloride in aqueous solutions, A., ii, 256.
- behaviour of some halogen compounds of the carbon group analogous to stannic chloride, A., ii, 731.
- Kowarsky, Albert**, simplification of the phenylhydrazine test [for sugar in urine], A., ii, 54.
- Kozai, Yoshinao**, chemical and biological researches on the preparation of "sake," A., ii, 748.
- Kraemer, Gustav**, and *Adolf Spilker*, wax of Bacillariaceæ and its connection with petroleum, A., i, 78.
- resin oil, A., i, 150.
- decomposition of viscous substances (lubricating oils) by distillation under pressure, A., i, 617.
- indene, and coumarone resins, A., i, 656.
- Kraft, Albert**. See *Fritz Fichter*.
- Kraft, Friedrich**, configuration and classification of aliphatic compounds, A., i, 577.
- Kraith, A.** See *August Klages*.
- Kramer**. See *Friedrich Kehrman*.
- Kraus, Charles A.** See *Edward C. Franklin*.
- Krauss, E. H.** See *Carlo Viola*.
- Kreis, Hans**, and *Ernst Budin*, detection of phytosterol and cholesterol in fats, A., ii, 252.
- Kreis, Hans**, and *Otto Wolf*, rapidity of saponification of some fats, A., ii, 324.
- Kreitling**, employment of floats in burettes, A., ii, 685.
- Kremers, Edward**. See *Oswald Schreiner*.
- Krieger, H.** See *Otto Cohnheim*.
- Kronberg, H.**, the Friedel-Crafts' reaction, A., i, 502.
- Krügel, C.** See *Albert Ladenburg*.
- Krüger, Friedrich**, electrolytic solution pressure: reply to *Lehfeldt*, A., ii, 706.
- Krüger, Martin**, degradation of caffeine in the organism of the dog, A., ii, 30, 93.
- Krüger, Martin**, and *Paul Schmidt*, decomposition of theobromine, paraxanthine, and 4-methylxanthine in the animal organism, A., ii, 31.
- Krüger, O.** See *Friedrich Kehrman*.
- Krüger, Th. Richard**, nucleons, A., i, 128.
- Krüger, W.**, and *W. Schneidewind*, almit, A., ii, 164.
- Krug, William H.**, and *Frank Kenneth Cameron*, the system; water, phenol, and hydrochloric acid, A., ii, 393.
- Krummacker, Otto**, influence of sodium chloride solution injected subcutaneously on proteid metabolism, A., ii, 670.
- Krusenstiern**. See *Carl Adam Bischoff*.
- Kudernatseh, Richard**, hexethylidene-tetramine, A., i, 337.
- Küsel, George C.** See *Mary E. Pennington*.
- Küster, Friedrich Wilhelm**, separation of barium, strontium, and calcium by mixed carbonate and sulphate solutions of varying composition, A., ii, 108.
- Küster, Friedrich Wilhelm**, and *F. Crotogino*, potential of the iodine electrode, A., ii, 255.
- Küster, Friedrich Wilhelm**, and *A. Thiel*, fusion of sodium thiosulphate; hydrates, A., ii, 68.
- estimation of sulphuric acid in the presence of iron, A., ii, 242.
- potential of silver in solutions of its mixed halogen salts, A., ii, 255.
- Küster, William**, products of the decomposition of hæmatin, A., i, 68, 319.
- Küster, William**, and *Martin Kille*, preparation of products of decomposition of hæmatoporphyrin, A., i, 69.
- Kuhara, Mitsuru**, and *Masumi Chikashigé*, formation of indigotin from diphenyldiketopiperazine, A., i, 560.
- determination of melting points, A., ii, 260.
- Kunckell, Franz**, new method of preparing aromatic amino-ketones, A., i, 664.

- Kunckell, Franz**, and **F. Gotsch**, α -dichlorostyrenes and some acetylenes, A., i, 638.
- Kunckell, Franz**, (and in part with **G. Hecker**, and **G. Treutler**), halogenised aromatic amino-ketones, A., i, 663.
- Kurnakoff, Nicolai S.**, ethylenediamine compounds of nickel, A., i, 209.
- compounds of metals among themselves, A., ii, 277.
- Kurnakoff, Nicolai S.**, and **N. J. Gwosdareff**, ethylenediamine compounds of palladium, A., i, 209.
- Kursanoff, Nicolai**, action of zinc methyl and zinc ethyl on chlorohexanaphthene, A., i, 19.
- cyclic compounds; ethylhexanaphthene and mercurioheptanaphthene iodide, A., i, 89.
- Kusserow, R.**, [effect of mineral and nitrogenous nutritive matters on the fermenting capacity of yeasts], A., ii, 38.
- Kutscher, Fr.**, detection of glutamic acid amongst the products obtained by decomposing albumin of animal origin with strong sulphuric acid, A., i, 67.
- antipeptone, A., i, 72.
- Kutscher, Fr.** See also **Albrecht Kossel**.
- Kutanetsoff, P.**, hydrates of manganous iodide, A., ii, 657.
- Kuwahara, T.** See **K. Katsuyama**.
- Kym, Otto**, action of chlorodinitrobenzene on potassium benzoate and on acetamide, A., i, 158.
- amino-derivatives of α -phenylbenzothiazole, A., i, 190.

L.

- Laar, J. J. van**, partial association of liquid molecules, A., ii, 189.
- relation between heat of solution and solubility of electrolytes, A., ii, 708.
- Labbe, Henri**, natural cyclic isomeric change of citronellal, A., i, 136.
- formation of barium citryl and citronellyl sulphites, A., i, 187.
- fixation of sodium hydrogen sulphite by ethylene linkings, A., i, 149.
- preparation of anisaldehyde, A., i, 177.
- a dihydrosulphonic acid derived from carvone, A., i, 398.
- [estimation of carvone in essential oils], A., ii, 454.
- Labhardt, Hans**, and **K. von Zembruksi**, asymmetrical disubstituted hydrazones, A., i, 125.
- Labhardt, Hans**. See also **Hans Rupe**.
- Laborde, E.**, influence of some alcohols of simple or complex function on the digestion of proteids by pepsin or trypsin, A., ii, 151.
- Laborde, J. B. Vincent**, and **L. Moreau**, estimation of succinic acid in fermented liquids, A., ii, 114.
- Labourasse, G.** See **Paul Petit**.
- Laeh, Theodor**. See **Heinrich Limprieh**.
- Lachman, Arthur**, Bewad's triethylamine oxide, A., i, 380.
- diethylhydroxylamine, A., i, 380.
- quinquivalent nitrogen, A., i, 380.
- preparation of zinc ethyl, A., i, 542.
- acetylene gas as fuel for chemical laboratories, A., ii, 593.
- Lacroix, Alfred**, prehnite in metamorphosed limestone, A., ii, 604.
- Ladenburg, Albert**, ozone, IV., A., ii, 721.
- Ladenburg, Albert**, and **C. Krügel**, measurement of low temperatures, II., A., ii, 258.
- krypton, A., ii, 540, 723.
- Ladenburg, Albert**, and **K. Scholtze**, 2-methylpyridine-6-carboxylic acid, A., i, 409.
- Ladisch, Carl**. See **Alfred Einhorn**.
- Laer, van** [a beer disease], A., ii, 158.
- Lam, A.**, normal refractometric value of butter, A., ii, 634.
- Landau, Josef**, mixed esters of cochinelic acid, A., i, 661.
- diketohydrindene derivatives of cochinelic acid, A., i, 661.
- trisdihydroxybenzoylenebenzene, A., i, 667.
- Lander, George Druce**, alkylation by means of dry silver oxide and alkyl halides, T., 729; P., 1900, 6, 90.
- Landin, John**, detection of sucrose in lactose, A., ii, 514.
- Landolt, Hans** [**Heinrich**], **Wilhelm Ostwald**, and **Karl Seubert**, second report of the committee of the German Chemical Society on atomic weights, A., ii, 533.
- Landsiedl, Anton**. See **Max Bamberger**.
- Lang, Robert**, magnetic force of the atoms, A., ii, 707.
- Lang, S.**, excretion of sulphur after extirpation of the liver, A., ii, 556.
- Lange, A.**, some properties of liquid chlorine, A., ii, 649.
- Langkopf, Otto**, detection of salicylic acid in the presence of citric acid, A., ii, 695, 769.
- Langmuir, A. C.**, estimation of sulphur in bitumens, A., ii, 310.
- estimation of nickel in nickel ores, A., ii, 316.

- Lansser, Theodor, and Fritz Wiedermann**, halogen-substituted indone derivatives of β -diketones, A., i, 666.
- Lapicque, Louis, and H. Gilardoni**, amount of iron present in the haemoglobin of the horse, A., i, 467.
- Lapworth, Arthur**, derivatives of cyanocamphor and of homocamphoric acid, T., 1053; P., 1900, 128.
- on the function of the characteristic meta-orientating groups, P., 1900, 108.
- condensation of ethyl crotonate with ethyl oxalate, P., 1900, 132.
- Lapworth, Arthur, and Edgar Marsh Chapman**, action of fuming nitric acid on α -dibromocamphor, T., 309; P., 1900, 4.
- camphonic, homocamphoric, and camphononic acids, T., 446; P., 1900, 56.
- Larsen, Absalon**, influence of temperature on the electrical conductivity of dilute amalgams, and the solubility of metals in mercury, A., ii, 255.
- Larsen, H. C.**, importance of various plants employed for green-manuring in increasing the amount of nitrogen in the soil, A., ii, 505.
- Lasne, Henri**, detection of adulterations in bone superphosphate, A., ii, 167, 311.
- Laurent, Charles**, ammonium chromous sulphate, A., ii, 547.
- Laurent, J.** See *Émile Bourquelot*.
- Lawrence, William Trevor**, the condensation of ethyl α -bromoisobutyrate with ethyl malonates and ethyl cyanoacetates: α -methyl- α -isobutylglutaric acid, P., 1900, 154.
- methylisoamylsuccinic acid, II., P., 1900, 156.
- Lawrence, William Trevor**. See also *W. Carter*.
- Lawes, Sir John Bennet, and Sir Joseph Henry Gilbert**, agricultural, botanical, and chemical results of experiments on the mixed herbage of permanent grass land, conducted for many years in succession on the same land. III. The chemical results. Sect. I., A., ii, 499.
- Lawroff, D.**, decomposition products of histon from leucocytes, A., i, 71.
- benzoyl compounds of hexon bases, A., i, 110.
- action of arginine on the tryptic digestion of proteid, A., ii, 28.
- excretion of antipyrine by the animal body, A., ii, 741.
- Lawson, William**. See *W. Hodgson Ellis*.
- Leach, Albert E.**, foreign colouring matter in milk, A., ii, 451.
- estimation of fat in condensed milk, A., ii, 771.
- Lean, Bevan**, ethyl dibromobutane-tetracarboxylate and the synthesis of tetrahydrofurfuran-2:5-dicarboxylic acid, T., 103; P., 1899, 197.
- Leathes, J. B.**, ovarian mucoids, A., i, 318.
- Lebeau, Paul**, preparation of arsenides, antimonides, and alloys of the alkali metals, A., ii, 276.
- iron silicide, Fe_2Si , and its presence in ferro-silicons, A., ii, 729.
- Lebeau, Paul**. See also *Henri Moissan*.
- Lebedeff, S.**, *o*-methoxyphenyltrichloromethylcarbinol, A., i, 490.
- Le Bel, Joseph Achille**, stereochemistry of nitrogen, A., i, 15.
- conditions determining the stability of rotatory power, A., ii, 462.
- Le Blanc, Max, and Moritz Eckardt**, titration of persulphates, A., ii, 45.
- Lechartier, G.**, composition of the soils of the Canton Redon as regards lime, magnesia, potash, and nitrogen, A., ii, 432.
- arable soils of the Canton Redon with respect to phosphoric acid, A., ii, 433.
- Le Chatelier, Henri [Louis]**, change of volume during the hardening of hydraulic cements, A., ii, 140.
- application of the phase rule to alloys and rocks, A., ii, 197.
- expansion of fused silica, A., ii, 539.
- propagation of condensation waves in heated gases, A., ii, 645.
- development and propagation of an explosive wave, A., ii, 647.
- Lee, Frederic S., and C. C. Harrold**, action of phloridzin on muscle, A., ii, 558.
- Lee, N. J. van der**, influence of pressure on the critical temperature of complete mixture, A., ii, 129.
- Leent, Frederik Hendrik van**, distinction of indigo from other blue dyes on fabrics, A., ii, 457.
- Lees, Charles H.**, thermal conductivities of mixtures and of their constituents, A., ii, 333.
- Lees, Frederick H., and William Henry Perkin, jun.**, action of aluminium chloride on camphoric anhydride, III., P., 1900, 18.
- Lees, Frederick H.** See also *Samuel Barnett Schryver*.
- Lefebvre, P.**, action of amyl chloride on calcium carbide, A., i, 323.

- Léger, Eugène**, aloins, A., i, 512.
Legros, G. See **Léon Grimbert**.
Lehfeldt, R. A., theory of the electrolytic solution pressure, A., ii, 62.
Lehmann, Karl Bernhard, estimation of small quantities of zinc in organic substances, especially in apple chips, A., ii, 170.
Lehmann, M. See **Oscar Kellner**.
Lehmann, Martin, volumetric estimation of iodoform in dressings, A., ii, 372, 767.
 — volumetric estimation of corrosive sublimate in dressing materials, A., ii, 443, 511.
Leidig, Emil, rhodicyanides, A., i, 212.
 — sesquichlorides of rhodium and iridium, A., ii, 146.
Leipsiger, Richard, metabolism with edestin, A., ii, 223.
Lemke, J. See **Alexander P. Sabanéeff**.
Lehmann, Otto. See **Theodor Pfeiffer**.
Lemoine, Georges, transformation of styrene into metastyrene under the influence of light, A., i, 91.
Langyel, Béla von, radio-active barium, A., ii, 402.
Lenher, Victor, some new tellurium compounds, A., i, 379.
Lenher, Victor, and **Hermann A. Loos**, decomposition of nickel carbonyl in solution, A., ii, 349.
Lenher, Victor, and **J. Livingston R. Morgan**, specific gravity and electrical resistance of tellurium, A., ii, 273.
Leonard, Norman, relation between the specific gravity, fat, and solids not fat, in milk, A., ii, 376.
 — analysis of golden syrup, A., ii, 447.
Leonard, Norman, and **Harry Metcalfe Smith**, polarimetric estimation of camphor in camphorated oil, A., ii, 699.
Leonard, Norman. See also **Richard Bodmer**.
Leonardi, G. See **Alberto Peratoner**.
Lepetit, Roberto, brazilin and hæmatoxylin as photographic developers, A., ii, 519.
Leroy, Émile, narceine, A., ii, 131.
 — meconin, opianic and hemipinic acids, A., ii, 261.
Léser, Georges, cyclic isomeric change of methyloctadienonol, A., i, 129.
 — cyclic β -diketones, I., A., i, 430.
Lespiau, Robert, γ -chlorocrotonic acid, A., i, 425.
Lessing, Rudolf. See **Richard Willstätter**.
Le Sueur, Henry Rondel, products of the action of fused potash on dihydroxystearic acid, P., 1900, 91.
Le Sueur, Henry Rondel, oil of *Carthamus tinctorius* (safflower oil), A., ii, 362.
Le Sueur, Henry Rondel. See also **Arthur William Crossley**.
Letour, F., precipitation of silver chloride by dimercurous ammonium chloride, A., ii, 246.
Letts, Edmund Albert, and **Robert Frederick Blake**, the carbon dioxide of the atmosphere, A., ii, 822.
 — simple and accurate method for estimating the dissolved oxygen in fresh-water, sea-water, sewage effluents, etc., A., ii, 755.
Letts, Edmund Albert, and **John Hawthorn**, the sea-weed *Ulva latissima*, and its relation to the pollution of sea-water by sewage, A., ii, 747.
Levaditi. See **Albert Charrin**.
Levene, P. A., mucin, A., i, 317.
 — preparation of nucleic acids, A., i, 572.
 — chemical changes in the developing egg, A., ii, 290.
Levene, P. A., and **C. L. Alsberg**, chemistry of the paranucleo-compounds, A., ii, 555.
Levene, P. A., and **Lafayette B. Mendel**, basic decomposition products of edestin, A., i, 318.
Levi, M. G., dissociation in colloidal solutions, A., ii, 646.
Levin, Isaac, mucin, A., ii, 295, 555.
Levinstein, Herbert. See **Eugen Samberger**.
Lewandowsky, Max. See **Immanuel Munk**.
Lewin, J. See **Adolf Pinner**.
Lewin, L. See **G. Schweinfurth**.
Lewin, Louis, [detection of] acetaldehyde and certain other aldehydes, A., ii, 179.
Lewis, Edward W. See **Henry Edward Armstrong**.
Lewis, Gilbert Newton, development and application of a general equation for free energy and physico-chemical equilibrium, A., ii, 264.
Lewis, J., composition of kraal manure, A., ii, 507.
Lewis, Percival, influence of slight impurity on the spectrum of a gas, II., A., ii, 1, 701.
 — fluorescence and afterglow accompanying an electric discharge in nitrogen, A., ii, 702.
Lewkowitsch, Julius, the theory of saponification, P., 1899, 190; discussion, P., 190.
 — determination of the iodine value, A., ii, 323.

- Lewkowitsch, Julius**, meaning of the acetyl value in fat analysis, A., ii, 323.
 — separation of oleic acid from other fatty acids, A., ii, 376.
- Ley, Heinrich**, chemistry of mercury. II. Mercuric salts of ketonic acids and the conversion of these into mercurioketonic acids, A., i, 382.
 — hydrolytic dissociation in salt solutions, A., ii, 67.
 — constitution of uranyl salts, A., ii, 731.
- Leyen, Elae von der**. See **Erich Harnack**.
- Léys, Alexandre**, detection of alkali chromates in milk, A., ii, 110.
- Lésé, R.**, estimation of fat in milk, A., ii, 324.
- Lieński**. See **Josef Tambor**.
- Lidoff, Alexander P.**, solution of copper in gelatin solution, A., ii, 77.
 — estimation of sulphur in naphtha, A., ii, 107.
- Liebermann, Carl [Theodor]**, compounds from rhubarb and allied substances, A., i, 355.
- Liebermann, Carl**, and **L. Flatow**, action of iodine on ethyl sodiodiketohydrindene-carboxylate, A., i, 667.
- Liebermann, Carl**, **P. Höring**, and **Fritz Wiedermann** [and in part **Messinger** and **J. Fränkel**], derivatives of carminic acid, A., i, 236.
- Liebermann, Carl** [and in part **E. Hoyer**], malonic acid derivatives of dibromo- α -naphthaquinone, A., i, 310.
- Liebermann, Carl**, and **C. N. Riiber**, bromine derivatives of quinzarin, A., i, 451.
 — boiling and subliming points of some allo-acids, A., i, 648.
- Liebkecht, Otto**, and **A. P. Wills**, molecular susceptibility of the paramagnetic salts of the iron group, A., ii, 187.
- Liebkecht, Otto**. See also **H. E. J. G. Du Bois**.
- Lieck, Hans**. See **Hermann Pauly**.
- Liecke, C.** See **August Klages**.
- Lillenthal**, feeding experiments with blood molasses, A., ii, 502.
 — feeding pigs with blood molasses, A., ii, 682.
- Limpach, Leonhard**. See **William Richard Eaton Hodgkinson**.
- Limpriecht, Heinrich**, benzophenone-2:4'-dicarboxylic acid, A., i, 32.
 — *p*-toluoyl-*p*-benzoic acid, and *pp*-benzophenonedicarboxylic acid, A., i, 598.
 — *o*-xylylphthaloylic acid and phthaloylphthalic acid, A., i, 599.
- Limpriecht, Heinrich**, *p*-toluoyl- β -propionic acid, A., i, 600.
- Limpriecht, Heinrich** [and **Theodor Lach**], diphenylmethane-2:4'-dicarboxylic acid, A., i, 31.
- Limpriecht, Heinrich**, and **Otto Wieand**, *p*-toluoyl-*o*-benzoic acid, A., i, 498.
- Linck, Gottlob Ed.**, [minerals in] the pegmatites of the Upper Veltlin, A., ii, 286.
 — G. Linck's crystallographic views, A., ii, 717.
- Lincoln, Azariah T.**, electrical conductivity of non-aqueous solutions, A., ii, 6.
 — physical reactions and the mass law, A., ii, 392.
- Lindauer, Gustav**, a glycol and aldol of the furfuran series, A., i, 305.
- Linde, Otto**, volumetric estimation of alkaloids, A., ii, 533.
- Linde, Otto**. See also **Julius Troeger**.
- Lindeck, St.** See **Wilhelm Jaeger**.
- Lindemann, W.**, fat of normal and degenerated heart muscle, A., ii, 32.
 — metabolism during poisoning with pulegone, A., ii, 223.
 — action of certain renal poisons, A., ii, 492.
- Lindet, Léon**, presence of dextrose and levulose in beet leaves, A., ii, 302.
 — estimation of fat in dairy produce, A., ii, 450.
- Linebarger, Charles Elijah**, surface tensions of mixtures of sulphuric acid and water, and the molecular mass of sulphuric acid, A., ii, 273.
- Lingenbrink, Edmund**. See **Max Busch**.
- Lingle, D. J.**, action of certain ions on ventricular muscle, A., ii, 739.
- Linnemann, Fried.** See **Otto Fischer**.
- Lintner, Carl Joseph**, fermentation of yeast, A., ii, 296.
 — mercurialisiclyclic acid and Millon's reaction, A., ii, 631.
- Lipschitz**. See **Carl Adam Bischoff**.
- Lischke, W.** See **Emil Fromm**.
- Litterscheid, Franz M.**, anagryrine, A., i, 513.
 — action of phenylthiocarbimide on cytosine, carpine, and conhydrine, A., i, 516.
- Litterscheid, Franz M.**, and **Karl Feist**, volumetric estimation of sulphuric acid, A., ii, 45.
- Living, George Downing**, effects of dilution, temperature, and other circumstances on the absorption spectra of solutions of didymium and erbium salts, A., ii, 517.

- Liversidge, Archibald**, blue pigment in coral (*Heliopora cœrulea*) and other animal organisms, A., i, 70.
- Liversidge, Archibald, William Skeay, and G. Grey**, composition and properties of the mineral waters of Australasia, A., ii, 288.
- Ljubavin, Nicolas N.** (with **Reswjakoff, Rudenko, and Areféeff**), naphtha tar, A., i, 23.
- Llaguet, B.**, action of ethyl mercaptan on some diatomic ketones, A., i, 503.
- Lobry de Bruyn, C. A.** See **Bruyn**.
- Loekyer, Sir Joseph Norman**, spectrum of silicon, A., ii, 181.
- Loequin, R.**, action of hexamethylene-tetramine on the esters of chloroacetic and bromoacetic acids, A., i, 589.
- Loeb, Arthur.** See **Paul Jacobson**.
- Loeb, Jacques**, ion-proteid compounds; the poisonous character of pure sodium chloride, A., ii, 227.
- different effect of ions on animal tissues, A., ii, 357.
- value of calcium and potassium ions in cardiac activity, A., ii, 491.
- artificial production of normal larvæ from unfertilised eggs of the sea urchin, A., ii, 555.
- artificial parthenogenesis, A., ii, 608.
- Löb, Wallher**, electrolytic preparation of colouring matters resembling indulines, A., i, 464.
- electrolytic preparation of benzidine, A., i, 697.
- researches on electrolytic reduction, A., ii, 706.
- Loeben, Wolf von.** See **Emil Fischer**.
- Lövinson, Oskar**, germination and growth of peas in solutions of salts of fatty acids, A., ii, 744, 745.
- Loew, Oscar**, replacement of potassium salts by rubidium salts in lower Fungi, A., ii, 36.
- Loew, Oscar.** See also **Rudolf Emmerich**.
- Löwenheim, Bruno.** See **Johannes Wislicenus**.
- Löwenherz, Richard**, decomposition by sodium of organic halogen compounds dissolved in amyl alcohol, A., ii, 838.
- Loewi, Otto**, nuclein metabolism, A., ii, 417.
- estimation of allantoin in urine, A., ii, 636.
- Loewy, A.**, oxygen in human blood, A., ii, 357.
- Lohse, Otto, and P. Thomaschewski**, asbestos filters, A., ii, 508.
- Loiseau, H.**, pallado-oxalic acid and pallado-oxalates, A., i, 542.
- Long, John Harper**, relation of the reducing power of normal urine to the amount of certain nitrogen compounds present, A., ii, 580.
- peculiarities in the urine of vegetarians, A., ii, 674.
- Longstaff, J. P.**, ammonium molybdate as a delicate reagent for stannous chloride, A., ii, 318.
- Loomis, Elmer Howard**, freezing point of aqueous solutions of non-electrolytes, A., ii, 335.
- Loos, Hermann A.** See **Victor Lenher**.
- Lord, E. C. E.**, [hornblende and anorthoclase], A., ii, 603.
- Lordkipanidzé, S.**, fluorohyperuranium compounds, A., ii, 658.
- Lordkipanidzé, S.** See also **Petr G. Melikoff**.
- Lorenz, Fritz.** See **Leopold Specht**.
- Lorenz, H. W. F.** See **Wilhelm Traube**.
- Lorenz, Richard**, change of free energy in fused halogen compounds of some heavy metals, A., ii, 61.
- electrolysis of fused salts, A., ii, 644.
- Lorenz, Richard**, [with **A. Helfenstein**], electrolysis of fused salts, A., ii, 333.
- Lorenz, Richard, and H. Wehrlin**, electrolysis of sodium chloride, A., ii, 476.
- Louguinine.** See **Luginin**.
- Lovisato, Domenico**, altered fayalite from the granulites of Villacidro, A., ii, 736.
- Low, Albert H.**, technical estimation of zinc, A., ii, 441.
- Lowry, Thomas Martin, and John H. West**, the persulphuric acids, T., 950; P., 1900, 126.
- Lubarsky, Eugene**, hydrocarbon, C_6H_{10} , from dimethylallylcarbinol, A., i, 422.
- Lublin, A.** See **Theodor Curtius**.
- Lucas, Ad.**, nitroacetone, A., i, 82.
- Lucehesi, Adolfo.** See **Ubaldo Antony**.
- Luck, A., and Charles Frederick Cross**, cellulose nitrates, A., i, 541.
- Ludewig, H.**, catecholacetic acid, A., i, 443.
- Ludwig, Ernst, and Theodor Panzer**, hot sulphur springs of Deutsch-Altenburg, A., ii, 90.
- Luedecke, Otto**, new occurrence of laumontite, A., ii, 218.
- Lührig, H.**, relative digestibility of certain fats in the human intestine. III. Butter and margarine, A., ii, 224.
- relative digestibility of certain fats in the human intestine. IV. Lard substitute ("Kunstspeisefett"), A., ii, 355.

- Lührig, H.**, comparative absorption [digestibility] and velocity of hydrolysis of certain fats, A., ii, 667.
- Lührig, H.** See also **Oscar Kellner**, and **A. Reinsch**.
- Lüthje, Hugo**, acetonnuria, A., ii, 229.
- Lüttringhaus, A.** See **Ludwig Wolff**.
- Luginin, Vladimir F.**, heat of vaporisation of nitriles and other organic compounds, A., ii, 334.
- Lunge, Georg**, and **J. Akunoff**, action of a mixture of benzene vapour and hydrogen on platinum and palladium black, A., i, 543.
- Lunge, Georg**, and **D. Segaller**, estimation of sulphites and thiosulphates in the presence of each other, A., ii, 366.
- Lunt, Joseph**, origin of certain unknown lines in the spectra of stars of the β -Crucis type, and the spectrum of silicon, A., ii, 586.
- Lusk, Graham**, influence of phloridzin diabetes on lactation, A., ii, 558.
- Lusk, Graham.** See also **F. H. Parker**.
- Luther, Robert**, reversible photochemical processes, A., ii, 181.
- the nature of the latent image and the so-called Eder test, A., ii, 253.
- Luther, Robert**, [and in part **D. R. Wilson**], electromotive behaviour of substances with several stages of oxidation, I., A., ii, 705.
- Lutoslawski, Jan**, nitrogen nutrition of leguminous plants, A., ii, 99.
- Lutschinin, Eugen.** See **Iwan L. Kondakoff**.
- Lutz, L.**, nutrition of plants with organic nitrogenous compounds, A., ii, 233.
- Lutsau, G. von.** See **Richard E. Meyer**.
- Lynch, Leo A.** See **Philip Embury Browning**.
- M.**
- Maas, Otto**, first cleavage product of proteid by the action of alkali, A., i, 708.
- Maas, Th.** See **Karl Auwers**.
- Maassen, Albert**, Bacteria which produce esters, A., ii, 231.
- Mabery, Charles Frederic**, and **D. M. Buck**, hydrocarbons in heavy Texas petroleum, A., i, 577.
- Mabery, Charles Frederic**, and **William R. Clymer**, estimation of carbon and hydrogen by combustion in oxygen using copper oxide, A., ii, 439.
- Mabery, Charles Frederic** [and in part **Edward J. Hudson**, **S. Takano**, and **W. O. Quayle**], composition of petroleum, A., i, 533.
- McCoy, Herbert N.**, apparatus for determining molecular weights by the boiling point method, A., ii, 387.
- McCrae, John**, and **T. S. Patterson**, acetyl and phenacetyl derivatives of diethyl *d*-tartrate, T., 1096; P., 1900, 161.
- McCrae, John.** See also **Harry Medforth Dawson**.
- MacDougal, D. T.**, copper in plants, A., ii, 235.
- MacDougall, Arthur**, and **Fred H. Howles**, production of nitric acid from air by means of the electric flame, A., ii, 651.
- Macfadyen, Allan**, and (in part) **Sydney Rowland**, influence of the temperature of liquid air on Bacteria, A., ii, 610.
- influence of the temperature of liquid hydrogen on Bacteria, A., ii, 610.
- MacGregor, James Gordon**, application of the dissociation theory to the electrolysis of aqueous solutions of two electrolytes with one common ion, A., ii, 62.
- finding the ionisation of complex solutions of given concentration, and the converse problem, A., ii, 332.
- Maeh, F.** See **Oscar Kellner**.
- Mellhiney, Parker C.**, determination of the bromine absorption of oils, A., ii, 178.
- linseed oil analysis, A., ii, 633.
- Macintyre, Alfred E.** See **Paul Duden**.
- MacIvor, R. W. Emerson**, analysis of chrome iron ore by the borax method, A., ii, 765.
- Mackay, P. A.**, analysis of zinc for cadmium and lead, A., ii, 49.
- McKee, Ralph H.** See **Julius Stieglitz**.
- McKenna, Alexander G.**, analysis of chrome- and tungsten-steels, A., ii, 765.
- McKenzie, Alexander.** See **Wilhelm Markwald**.
- McLennan, J. C.**, electrical conductivity in gases traversed by cathode rays, A., ii, 587.
- Macleod, J. J. R.**, phosphorus in muscle, A., ii, 92.
- Macleod, W. A.**, and **O. E. White**, new variety of garnet, A., ii, 663.
- McPherson, William**, constitution of the hydroxyazo-compounds, A., i, 123.
- McPherson, William**, and **Robert Fischer**, action of α -acylated phenylhydrazines on the chlorine derivatives of quinones, A., i, 411.
- Maercker, Max [Heinrich]**, manurial experiments with lucerne, A., ii, 41.

- Maercker, Max**, manurial experiments on meadow land, A., ii, 42.
 — accumulation of nitrogen by the cultivation of intermediate crops on loamy soil, A., ii, 102.
- Maercker, Max**, and **W. Schneidewind**, losses of the nitrogen of stable manure in covered and uncovered stalls, A., ii, 105.
- Magnanini, Gaetano**, and **F. Vannini**, evaluation of commercial calcium carbide, A., ii, 511.
- Magnanini, Gaetano**, and **V. Zunino**, apparatus for determining the calorific value of fuels, A., ii, 465.
 — thermal conductivity of nitrogen peroxide as effected by changes of temperature and pressure, A., ii, 525.
- Magnier de la Source, Louis**, necessary precautions in certain acidimetric estimations, A., ii, 620.
 — estimation of potassium hydrogen tartrate in wine, A., ii, 768.
- Magnus, R.**, changes in the composition of the blood after transfusion of sodium chloride, and their relationship to diuresis, A., ii, 665.
- Magnus-Levy, Adolf**, Bence-Jones albumin, A., i, 615.
 — hydroxybutyric acid and its relationship to diabetic coma, A., ii, 155.
- Mahla, Friedrich**, and **Ferdinand Tie-mann**, decomposition products of campherimine, A., i, 507.
- Mahon, R. W.**, estimation of chromium in steel, A., ii, 110.
- Maillard, Louis**, crystallised fibrin, A., i, 266.
 — colorimetric estimation of vanadium, A., ii, 577.
- Mainini, C.** See **Valentino Grandis**.
- Mainsbrecq, V.**, estimation of the insoluble fatty acids in butter, and the cause of differences in the results, A., ii, 114.
- Majstorović, R.** See **Alexander Zega**.
- Malcolm, J.** See **T. H. Milroy**.
- Malden, W. J.**, manurial experiments on permanent pasture, A., ii, 240.
- Malfitano, G.**, proteolysis produced by *Aspergillus niger*, A., ii, 493.
 — bacteriolysis of the *Bacillus anthracis*, A., ii, 677.
- Mall, F. J.** See **Philip Embury Browning**.
- Mallet, Frederic Richard**, anhydrous sulphates of the form $2M'SO_4, R_2SO_4$; especially those of isometric crystallisation, T., 216; P., 1899, 227.
 — langbeinite from the Punjab salt range, A., ii, 22.
- Mallet, John William**, physiological action of creatine and creatinine, and their value in nutrition, A., ii, 156.
- Malpeaux, L.**, alinit in the cultivation of cereals, A., ii, 498.
- Malpeaux, L.** See also **D. Dickinson**.
- Maltby, Margaret E.** See **Friedrich Kohlrausch**.
- Malus, C.**, viscosity of sulphur at temperatures above the point of maximum viscosity, A., ii, 536.
- Mamlock, Leonard**, and **Richard Wolfenstein**, action of hydrogen peroxide on aliphatic amines, A., i, 209.
- Manasse, E.**, tourmaline from Elba, A., ii, 287.
- Manasse, Paul**, multiple amyloid tumours in the upper air passages, A., ii, 295.
- Manchot, Wilhelm**, spontaneous oxidation, "autoxidation," and formation of active oxygen ("Sauerstoffaktivierung"), A., i, 300.
- Manchot, Wilhelm**, and **Johannes Herzog**, behaviour of potassium cobaltocyanide and of chromous compounds towards oxygen gas, A., ii, 546.
- Mankiewicz**, sulphosalicylic acid as a test for albumin [in urine], A., ii, 459.
- Manley, J. J.**, examination of sea water by an optical method, A., ii, 619.
- Manley, J. J.** See also **R. T. Günther**.
- Mann, G.** See **Karl Anwers**.
- Mann, Konrad**, estimation of cellulose in faeces, A., ii, 250.
- Mannheim, E.** See **Alfred Partheil**.
- Maquenne, Léon**, preparation of azelaic acid, A., i, 135.
 — partial synthesis of *l*-erythritol, A., i, 423, 472.
 — the "honey" of *Euonymus japonicus*, A., ii, 161.
 — germination, A., ii, 678.
- Marasonoff, N.** See **Wetschislav E. Tistschenko**.
- Marburg, Eduard C.** See **Karl A. Hofmann**.
- Marburg, Richard**, quantitative separation of tin, antimony, and arsenic, A., ii, 248.
- Marcet, William**, obituary notice of, T., 594.
- March, F.**, action of ethyl chloroacetate on sodioacetylacetone, A., i, 374.
- Marchant, E. W.** See **Lord Blythswood**.
- Marchlewski [Paul] Leon [Theodore]**, tautomerisation of isatin, A., i, 100.
 — chlorophyll, A., i, 243.
 — chemistry of chlorophyll; phyllobilin, A., i, 404.

- Marchlewski, Leon**, and **C. A. Schunck**, notes on the chemistry of chlorophyll, T., 1080; P., 1900, 148.
- Markwald, Wilhelm**, stereochemistry of nitrogen [propylisobutylamine], A., i, 143.
- behaviour of sulphonamides of primary amines towards alkalis, A., i, 149.
- dimethylenimine, A., i, 336.
- colour of picric acid and its solutions, A., i, 391.
- alkylation of indene, A., i, 434.
- phototropy, A., ii, 2.
- Markwald, Wilhelm**, and **M. Chain**, 2-lepidylhydrazine and 4-quinaldylhydrazine, A., i, 521.
- Markwald, Wilhelm, W. Klemm**, and **H. Trabert**, the pyridine series, II., A., i, 456.
- Markwald, Wilhelm**, and **Alexander McKenzie**, resolution of racemic compounds into active components, A., i, 207.
- Markwald, Wilhelm**, and **Erwin Meyer**, quinoline methiodide, A., i, 519.
- 2-quinolylhydrazine and its derivatives, A., i, 519.
- Markwald, Wilhelm**. See also **Werner Esch**.
- Marcus, Emil**, solubility of serum-globulin in water, A., i, 127.
- Mark, W.**, distillation of water, A., ii, 202.
- Marfori, Pio**, hydroxymethylanthraquinones, A., i, 553.
- Marie, Ch.**, estimation of phosphorus in organic compounds, A., ii, 108.
- electrolytic estimation of lead in the sulphate and chromate; application to the analysis of lead glass and lead chromates, A., ii, 368.
- Markownikoff, Wladimir B.**, cyclic compounds; behaviour of cyclic compounds at low temperatures, A., i, 18.
- quaternary paraffins, II., A., i, 469.
- oxidation of cyclic compounds; α -methyladipic acid, A., i, 475.
- secondary derivatives of heptanaphthene [methylcyclohexane], A., i, 579.
- Markownikoff, Wladimir B.** [with **K. Ballinsk**], salt from Lake Djouvan-Tubé, A., ii, 660.
- Markownikoff, Wladimir B.**, and **Wladimir Tscherdintseff** [and in part **Edmoff**], tertiary derivatives of heptanaphthene [methylcyclohexane], A., i, 578.
- Maronneau, Georges**, preparation of the phosphides of iron, nickel, cobalt, and chromium, A., ii, 281.
- Marshall, Arthur**, the iodine value of oils, A., ii, 376.
- Marshall, Hugh**, polarisation phenomena observed in quantitative electrolytic determinations, A., ii, 185.
- action of persulphates on iodine, A., ii, 203.
- hydrolysis of thallic sulphate, A., ii, 207.
- persulphates of rubidium, caesium, and thallium, A., ii, 277.
- Martin, Charles F.**, excretion of allo-uric substances in nephritis, A., ii, 155.
- Martin, Geoffrey**, existence of thermal centres of stability in compounds, A., ii, 589.
- Marsichi, Giulio**. See **Hugo Schiff**.
- Mascetti, E.**, ammonio-oxy-cobalt thiocyanates, A., i, 541.
- Maselli, C.**, synthesis of hydroxymethyl-o-benzoic sulphinide, A., i, 596.
- Massol, Gustave**, acidimetric value of substituted malonic acids compared with that of corresponding normal dibasic acids, A., i, 200.
- thermochemistry of gallic acid, A., i, 499.
- thermochemistry of 2:3:4-trihydroxybenzoic acid, A., i, 499.
- thermal study of protocatechuic or 3:4-dihydroxybenzoic acid; influence of phenolic hydroxyl, A., i, 600.
- thermochemistry of *n*-adipic acid, A., ii, 260.
- overflowing thermocalorimeter, A., ii, 386.
- Masson, [David] Orme**, Iceland spar as a standard in volumetric analysis, A., ii, 436.
- Massoulier, P.**, electrolytic conductivity and internal friction in saline solutions, A., ii, 331.
- Masuyama, M.** See **Johannes Müller**.
- Mathews, John Alexander**, laboratory method for the continuous and uniform generation of acetylene, and for its purification, A., i, 323.
- bismuth cobalticyanide, A., ii, 578.
- Mathews, John Alexander**, and **L. L. Watters**, gold carbide, A., i, 323.
- Mathews, John Alexander**. See also **Edmund Howd Miller**.
- Matignon, Camille**, some properties of aluminium; preparation of hydrogen phosphide, A., ii, 482.
- Matthews, Charles George**, and **A. Hyde Parker**, analysis of a sample of treacle and of so-called golden syrup, A., ii, 448.

- Matthews, Francis Edward**, hexachlorides of benzonitrile, benzamide, and benzoic acid, T., 1273; P., 1900, 175.
- Mauch, Richard**, physico-chemical properties of chloral hydrate and their applications to pharmacology, A., ii, 454.
- Mawrow, F.**, action of chlorine on cupric hydroxide suspended in potassium hydroxide, A., ii, 402.
- action of potassium persulphate on cobalt salts, A., ii, 596.
- separation of cobalt and nickel by means of persulphates, A., ii, 765.
- Maximovitch, Stephan**, pentahydric alcohol from methylallylcarbinol, A., i, 325.
- Maxwell, O. P.** See *F. J. Pond*.
- Maxwell, Walter**, [experiments on sugar-cane in Hawaii], A., ii, 304.
- Mayer, Adolf**, distribution of the diastatic enzyme in the potato plant, A., ii, 427.
- Mayer, Fritz**. See *Karl Auwers*.
- Mayer, Otto**. See *Robert Henriques*.
- Mayer, Paul**, phenylhydrazine derivatives of glycuronic acid, A., i, 204.
- excretion and detection of glycuronic acid in urine, A., ii, 155, 178.
- effect of the presence of glycuronic acid on the phenylhydrazine test for sugar in urine, A., ii, 320.
- Mayer, Paul**, and *Carl Neuberg*, glycuronic acid in normal urine, A., ii, 421.
- Maynard, George W.**, chromite from Newfoundland, A., ii, 86.
- Maxé, Pierre**, digestion of the reserves of seeds during germination, and their assimilation by the seedlings, A., ii, 300.
- influence of nitric and ammoniacal nitrogen on the development of maize, A., ii, 499.
- Massara, Girolamo**, and *V. Bertozzi*, 2-chloro-3-hydroxybenzoic and 2:6-dichloro-3-hydroxybenzoic acids, A., i, 596.
- Mead, L. D.** See *William J. Gies*.
- Meade, Richard K.**, new volumetric method for the estimation of magnesium, A., ii, 48.
- estimation of zinc by the use of standard thiosulphate solution, A., ii, 575.
- Meade, Richard K.**, and *James C. Attix*, estimation of volatile combustible matter in coke and anthracite coal, A., ii, 168.
- Mecke, alkaloid** resembling aconitine found in a corpse, A., ii, 120.
- Mecke**, detection of yolk of egg in margarine, A., ii, 123.
- a new alkaloidal reagent; detection of opium, A., ii, 180.
- detection of sucrose in margarine, A., ii, 319.
- Medanich, G.** See *Zdenko Hanns Skraup*.
- Medvedeff, An. K.**, oxidation in animal tissues, A., ii, 788.
- Meerburg, P. A.**, derivatives of pyrotartaric acid and of the isomeric glutaric acid, A., i, 143.
- Mehring, H.**, an addition to the apparatus for Kjeldahl's nitrogen estimation, A., ii, 509.
- Meigen, Wilhelm**, and *W. Normann*, action of hypochlorous acid on primary aromatic amines, A., i, 702.
- Melhuizen, S. H.** See *Louis Aronstein*.
- Meillère, G.**, estimation of chlorine in gastric juice, A., ii, 509.
- Meine, W.** See *Julius Troeger*.
- Meisenheimer, Jakob**. See *Johannes Thiele*.
- Meldola, Raphael**, and *Lewis Eynon*, aminoamidines of the naphthalene series, T., 1159; P., 1900, 166.
- Meldola, Raphael**, and *Elkan Wechsler*, note on the elimination of a nitro-group during diazotisation, T., 1172; P., 1900, 167.
- Meldola, Raphael**, and *William Arthur Williams*, notes on polyazo-compounds, P., 1899, 196.
- Melikoff, Petr G.**, haloid hydroxy-acids, A., i, 536.
- Melikoff, Petr G.**, and *S. Lordkipanidzé*, fluorohyperborates, A., ii, 138, 139.
- Mellor, J. W.**, Bunsen's ice calorimeter, A., ii, 334.
- Melsbach, H.** See *Theodor Curtius*.
- Meltzer, S. J.**, toxicology of potassium chlorate, A., ii, 296.
- Melsi, Gilberto**. See *Ettore Artini*.
- Mendel, Lafayette B.**, iodine in the thymus and thyroid, A., ii, 152.
- iodine in corals, A., ii, 677.
- Mendel, Lafayette B.**, and *Ernest W. Brown*, nitrogenous metabolism in the cat, A., ii, 151.
- Mendel, Lafayette B.**, and *Holmes C. Jackson*, nitrogenous metabolism after splenectomy, A., ii, 288, 607.
- Mendel, Lafayette B.**, and *R. Nakaseko*, chemistry of the lymphatic glands, A., ii, 556.
- Mendel, Lafayette B.**, and *E. C. Schneider*, thiocyanate in human saliva, A., ii, 554.
- Mendel, Lafayette B.** See also *P. A. Levene*.

- Menne, Ernest**, ψ -carbamides, A., i, 286.
- Mennicke, H.**, detection of nitrous acid in water by means of aminonaphthol K-acid [1-amino-8-hydroxynaphthalene-4:6-disulphonic acid], A., ii, 438.
- detection of nitrous acid in water, A., ii, 621.
- analyses of lead and tin ores, also of the most important lead and tin preparations and their commercial products, A., ii, 688, 761.
- Menozzi, Angelo**, comparison between bone- and mineral-superphosphates, A., ii, 43.
- Menschutkin, Boris N.** See *Alessi A. Wolkoff*.
- Menschutkin, Nicolai A.**, reaction for distinguishing differently substituted amines, A., i, 335.
- influence of the side chain on the properties of open and closed chain carbon compounds. V. Velocity of combination of secondary amines with alkyl bromides, A., i, 335.
- structure of acid amides, A., i, 337.
- influence of the side chain on the properties of open and closed chain carbon compounds. VI. Influence of chemically indifferent solvents on the comparative velocity of reaction in isomeric benzene derivatives, A., i, 341.
- Mergenthaler.** See *Carl Adam Bischoff*.
- Merrill, George Perkins, and Henry N. Stokes**, new meteorites from Allegan, Michigan, and Mart, Texas, A., ii, 737.
- Mers, Victor, and H. Strasser**, naphthylated benzidines, A., i, 253.
- preparation of resorcinol monomethyl ether, A., i, 289.
- diaminodixenylamine, A., i, 313.
- action of tetramethyldiaminobenzophenone on α -dinaphthylbenzidine, A., i, 314.
- Messerschmitt, Anton.** See *Heinrich Goldschmidt*.
- Messinger.** See *Carl Liebermann*.
- Messinger, Josef**, estimation of salicylic acid, A., ii, 514.
- Metchnikoff, Elié**, cytotoxins, A., ii, 741.
- Metchnikoff, Elié, and Besredka**, action of hæmatotoxin on man, A., ii, 741.
- Methner, Th.** See *Oscar Kellner*.
- Meulen, H. ter**, glucosides containing thiocarbimides, A., i, 511.
- Meulen, H. ter.** See also *Sebastian Hoogewerff*.
- Meunier, Louis**, metallic derivatives of diazoaminobenzene, A., i, 571.
- Meunier, Louis, and A. Bigot**, a cuprous salt of diazoaminobenzene, A., i, 316.
- Meunier, Louis.** See also *Léo Vignon*.
- Mensser.** See *Otto Ruff*.
- Meves, Wilhelm**, action of cyanogen on aromatic amines, A., i, 483.
- Meyer, Erwin.** See *Wilhelm Markwald*.
- Meyer, Fred. C.** See *Robert Behrend*.
- Meyer, Hans**, action of ammonia on lactones, A., i, 9.
- tetrabromophenolphthalein, A., i, 447.
- theory of narcosis, A., ii, 156.
- Meyer, Jacob, and Martin Bohmer**, action of formaldehyde on *o*-nitroaniline, A., i, 222.
- Meyer, Kirstine, (née Bjerrum)**, corresponding states, A., ii, 263.
- Meyer, Richard E.**, coloured sulphur compounds of the diphenyl- and triphenyl-methane series, I., A., i, 660.
- Meyer, Richard E., and G. von Lutsau**, formation and stability of acid amides, A., i, 643.
- Meyer, Richard E., and J. Szaneczki**, coloured sulphur compounds of the diphenyl- and triphenyl-methane series, II., A., i, 660.
- Meyer, Richard Jos., and Hans Best**, manganese trichloride and tetrachloride, A., ii, 77.
- chromyl chloride, chlorochromic acid, and aminochromic acid, A., ii, 79.
- Meyer, Richard Jos., and Richard Jacoby**, double nitrates of quadrivalent cerium and of thorium, A., ii, 597.
- Meyer, Richard Jos., [and in part C. Wiegand]**, tervalent thallium, A., ii, 655.
- Meyer, Stefan**, magnetic susceptibility of inorganic compounds, A., ii, 7.
- specific gravity of yttrium, zirconium, and erbium, A., ii, 143.
- molecular susceptibility of the salts of the rare earths, A., ii, 186.
- determination of some co-efficients of magnetic susceptibility, A., ii, 385.
- atomic and molecular magnetism, A., ii, 385.
- additivity of atomic heat, A., ii, 464.
- additive nature of the properties of atoms, A., ii, 533.
- Meyer, Victor**, memorial lecture on (Thorpe) T., 169; P., 1900, 33.
- Meyerhoffer, Wilhelm, and A. P. Saunders**, reciprocal salt pairs. II. Equilibrium phenomena in presence of a double salt, A., ii, 198.

- Meyerhoffer, Wilhelm.** See also *Jacobus Henricus van't Hoff*.
- Michael, Arthur,** certain laws and their application in organic chemistry, A., i, 321.
- Michael, Arthur, and Wallace T. Conn,** chlorine heptoxide, A., ii, 471.
- Michaelis, [Carl Arnold] August, and Heinrich Behn,** 5-chloro- and 5-bromo-1-phenyl-3-methylpyrazoles, A., i, 693.
- Michaelis, August, and M. Fitsch,** the lower oxides of phosphorus, A., ii, 137.
- Michaelis, August, and P. Schindler,** action of thionyl chloride on dimethylaniline and diethylaniline, A., i, 215.
- Michaelis, August, and G. Schwabe,** 1-p-bromophenyl-3-methyl-5-chloropyrazole, A., i, 695.
- Michaelis, August, and Th. Sudendorf,** 5-chloro-1-p-tolyl-3-methylpyrazole and antipyrine-*Bz*-carboxylic acid, A., i, 696.
- Michailenko, Jakov I., and W. P. Javorsky,** action of zinc on a mixture of ethyl bromoisobutyrate and ethyl formate. II. Action of hydriodic, hydrobromic, and sulphuric acids on β -hydroxy- γ -tetramethylglutaric acid, A., i, 586.
- Michel, Fr.,** 2:3-dichloro- α -naphthaquinolyl derivatives of β -diketones, A., i, 669.
- Michel, Léopold.** See *Léon Garnier*.
- Micko, Karl,** the active principle of Cayenne pepper, A., ii, 58.
- comparative investigation of the fæces after feeding on meat and plasmon, A., ii, 422.
- Mie, August,** an application of Poynting's theorem, A., ii, 703.
- Mietaschke, W.,** estimation of iridium in alloys of the noble metals, A., ii, 371.
- Mignot, André,** volumetric estimation of manganese in pig-iron, cast-iron, and steel, A., ii, 690.
- Migula, W.,** nitrification in the soil of forests, A., ii, 744.
- Milch, Ludwig,** rocks from Sumatra, A., ii, 150.
- Miller, Alexander K., and J. P. Potts,** analysis of some sugar syrups, A., ii, 320.
- Miller, Edmund Howd, and Henry Fisher,** lead and cadmium ferrocyanides, A., ii, 761.
- Miller, Edmund Howd, and E. J. Hall,** titration of zinc with potassium ferrocyanide, A., ii, 638.
- Miller, Edmund Howd, and John Alexander Mathews,** cobalticyanides, A., ii, 318.
- Miller, Norman Harry John,** experiments at Rothamsted on the changes in the composition of mangels during storage, A., ii, 430.
- Miller, Willet G.,** corundum-bearing rocks of E. Ontario, A., ii, 552.
- Miller, Willet G.** See also *William L. Goodwin*.
- Miller, William Lash, and Frank B. Kenrick,** lecture experiments; reversible chemical reactions, A., ii, 534.
- quantitative lecture experiments on electrochemistry, A., ii, 703.
- Millington, J. P., and H. Hibbert,** an isomeride of furfurene, P., 1900, 161.
- Mills, Edmund James, John Imrie, and Archibald Gray,** relation of the ash to the height of plants, A., ii, 496.
- Mills, William Sloan,** diphenyl- and dialkyl-ethylenediamines, and their nitro-derivatives, nitrates, and mercurichlorides, T., 1020; P., 1900, 127.
- Milner, S. Roslington,** theory of solution pressure, A., ii, 385.
- Milroy, T. H., and J. Malcolm,** metabolism of nucleins, A., ii, 91.
- Minguin, Jules,** resolution of racemic benzyldenecamphor: isomorphism of the active components, A., i, 301.
- Minguin, Jules.** See also *Albin Haller*.
- Minossi, A.,** synthesis of glutaric and trimethylene derivatives, A., i, 406.
- Minski.** See *Carl Adam Bischoff*.
- Minssen, H., and Bruno Tacke,** solubility of the phosphoric acid of basic slag and crude phosphates in peat soils; dependence of the solubility on the amount of free humic acid in the soil, A., ii, 618.
- Minssen, H.** See also *Bruno Tacke*.
- Mintrop, W.** See *Eberhard Bamm*.
- Minunni, Gaetano,** action of hydroxylamine on dehydracetic acid, A., i, 198.
- [acylation] in presence of pyridine, A., i, 214.
- dibenzyldeneacetoneoxime, A., i, 237.
- dipiperonaldiphenylhydrotetrazone and its isomeric transformations, A., i, 259.
- Minunni, Gaetano, and C. Carta-Satta,** action of hydroxylamine hydrochloride on ketones of the type $\text{CO}(\text{CH}:\text{CHR})_2$ in presence of sodium acetate, A., i, 237.
- replacement of the aldehyde group $\text{R}\cdot\text{CH}$: by benzoyl in hydrazine derivatives, A., i, 251.

- Minunni, Gaetano**, and **C. Carta-Satta**, new aldazines and their behaviour towards benzoyl chloride, A., i, 251.
- oxidation of salicylaldehyde-phenylhydrazone, A., i, 260.
- Minunni, Gaetano**, and **Giovanni Ortoleva**, oxidation of cinnamaldehyde-phenylhydrazone, A., i, 260.
- chloro-derivatives of oxygenated alkaloids; action of chlorine on strychnine in glacial acetic acid solution, A., i, 309.
- Miolati, Arturo**, ammonio-cobalt thiocyanates, A., i, 381.
- platinum tetrachloride, A., ii, 214.
- Miolati, Arturo**, and **I. Bellucci**, pentachloroplatinic acid, A., ii, 732.
- platinum tetrabromide, A., ii, 732.
- Mitchell, A. S.**, lemon flavouring extract and its substitutes, A., ii, 174.
- Mitchell, F. H.** See **Allen Rogers**.
- Mitchell, Leeds**. See **Henry Lord Wheeler**.
- Mixer, William Gilbert**, products of the explosion of acetylene, A., i, 197.
- products of the explosion of acetylene and of mixtures of acetylene and nitrogen, A., i, 618.
- Möhlau, Richard**, and **W. G. Schaposchnikoff**, action of tetramethyldiaminobenzhydrol on rosinduline and on isorosinduline, A., i, 367.
- Möhlau, Richard**, and **Erich Strohbach**, Abel's dibenzeneazo- β -dinaphthol-methane and dinitroso- β -dinaphthol-methane, A., i, 368.
- Möller, E.** See **Eberhard Ramm**.
- Möller, Johann**, formation of phenyl-carbylamine by the electrolysis of alkaline alcoholic solutions of nitrobenzene and aniline, A., i, 27.
- Mörner, Carl Thore (Graf)**, preparation of gelatin, A., i, 128.
- Mörner, Karl Axel Hampus**, cystin, a decomposition product of keratin, A., i, 128.
- Mohr, Ernst**, conversion of diethyl lutidinecarboxylate into diaminolutidine, A., i, 409.
- Moir, James**. See **Francis Robert Japp**.
- Moissan, Henri**, production of ozone by the decomposition of water by fluorine, A., ii, 13.
- commercial calcium carbide, A., ii, 15.
- calcium and its compounds, A., ii, 76.
- action of hydrogen fluoride and fluorine on glass, A., ii, 140.
- volumetric composition of hydrogen fluoride, A., ii, 271.
- Moissan, Henri**, preparation and properties of a manganese perfluoride, A., ii, 280.
- preparation and properties of neodymium and praseodymium carbides, A., ii, 726.
- Moissan, Henri**, and **Paul Lebeau**, sulphur perfluoride, a new gas, A., ii, 341.
- density and analysis of sulphur perfluoride, A., ii, 342.
- preparation, properties, and analysis of thionyl fluoride, A., ii, 472.
- Moissan, Henri**, and **Alfred Stock**, preparation and properties of the silicon borides, SiB_2 and SiB_3 , A., ii, 539.
- Moissan, Henri**, and **Venturi**, manganous fluoride, A., ii, 405.
- Mokiewsky, Wladimir**, isoprene, A., i, 509.
- Molenda, Oskar**, estimation of water in syrups and similar products, A., ii, 309.
- Molinari, Ettore**, conversion of dimethylmaleic anhydride into dimethylfumaric acid, A., i, 374.
- Molisch, Hans**, occurrence of indican in the chlorophyll grains of the indigo plant, A., ii, 101.
- Mommers, Richard**. See **James F. Norris**.
- Momson, C.** See **Eberhard Ramm**.
- Montagne, P. J.**, action of anhydrous nitric acid on the isomeric chlorobenzoic acids and their derivatives, A., i, 491.
- Montanari, Carlo**, rapid estimation of the purity of commercial copper sulphate, and of the amount of copper sulphate in copper pyrites, A., ii, 315.
- Monvoisin**, vegetation of some fodder plants, A., ii, 303.
- Moor, Cresacre George**, and **Martin Priest**, coffee extracts, their composition and analysis, A., ii, 379.
- Moore, Benjamin**, bile as a solvent, A., ii, 291.
- Moore, Benjamin**, and **T. J. Bergin**, chemical reaction of the intestinal contents, A., ii, 154.
- Moore, Benjamin**, and **William H. Parker**, formation of lactose, A., ii, 671.
- Moore, Benjamin**, and **C. O. Purinton**, suprarenal extracts, A., ii, 295.
- physiology of the suprarenal capsules, A., ii, 492.
- the influence of minimal doses of suprarenal extracts on blood-pressure, A., ii, 737.
- Moore, Charles C.**, analyses of sandstone concretions, A., ii, 150.

- Moore, F. J.**, removal of a sulpho-group by reduction, A., i, 550.
- Moore, M. J.**, estimation of sulphur in pig iron, A., ii, 106.
- Moore, Russell W.**, free fatty acids in olive oil, A., ii, 376.
- Moore, Thomas**, estimation of cobalt in New Caledonian ores, A., ii, 764.
- separation and estimation of small quantities of cobalt in the presence of nickel, A., ii, 764.
- Moore, T. Sidney**, reversibility of voltaic cells, A., ii, 381.
- Moraczewski, Wacław von**, excretion in blood-free and in fasting frogs, A., ii, 31.
- metabolism in pernicious anæmia, A., ii, 295.
- Moreau.** See *Paul Caseneuve*.
- Moreau, L.** See *J. B. Vincent Laborde*.
- Morel, Albert**, reactions of phenyl chloroacetate, A., i, 157.
- reactions of phenyl chloroacetate and phenyl glycolate, A., i, 158.
- Morello, Antonio**, energy of acids dissolved in mixtures of organic solvents and water, A., ii, 395.
- Moreschini, R.**, phenomenon noticed in the cooling of superfused substances, A., ii, 465.
- Morgan, Gilbert Thomas**, action of formaldehyde on amines of the naphthalene series. Part II., T., 814; P., 1900, 131.
- contribution to the chemistry of the aromatic metadiamines, T., 1202; P., 1900, 170.
- action of aromatic aldehydes on derivatives of β -naphthylamine, T., 1210; P., 1900, 171.
- Morgan, John Livingston Rutgers**, three additions to the Kohlrausch-Ostwald conductivity method, A., ii, 255.
- electrolytic deposition of brass, A., ii, 345.
- Morgan, John Livingston Rutgers**, and *W. A. Duff*, chromium cell for the rectification of alternating currents, A., ii, 588.
- Morgan, John Livingston Rutgers**, and *W. L. Hildburgh*, determination of electrical conductivity with direct current instruments, A., ii, 521.
- Morgan, John Livingston Rutgers.** See also *Victor Lenher*.
- Morgan, William Conger**, space isomerism of the ethers of toluquinone-oxime, A., i, 103.
- Morgan, William Conger.** See also *John L. Bridge*.
- Morini, Umberto**, modification of Duclaux's method for estimating total solids and fat in milk, A., ii, 321.
- Morishima, Kurata**, occurrence of lactic acid in the animal organism in reference to arsenical poisoning, A., ii, 296.
- Moritz, B.**, electrolysis through semi-permeable membranes, A., ii, 522.
- Morkowin, N.**, protamines, A., i, 72.
- Morley, Frederick H.** See *Frank A. Gooch*.
- Morpurgo, Giulio**, and *Alb. Gütal*, adulteration of cotton seed oil with maize oil, A., ii, 377.
- Morrell, Robert Selby**, and *James Murray Crofts*, action of hydrogen peroxide on carbohydrates in the presence of ferrous salts, II., T., 1219; P., 1900, 171.
- Morris, Julia C.** See *Frank A. Gooch*.
- Morse, Harmon Northrup**, and *H. G. Byers*, cause of the evolution of oxygen when oxidisable gases are absorbed by permanganic acid, A., ii, 406.
- Morse, Harmon Northrup**, and *D. W. Horn*, action of carbon dioxide on the borates of barium, A., ii, 626.
- Morse, Harmon Northrup**, and *J. C. Olsen*, [preparation of] permanganic acid by electrolysis, A., ii, 482.
- Morton, D. A.** See *William R. Orndorff*.
- Moschner, J.**, hydrindene and a new hydroxyhydrindene, A., i, 844.
- Moses, Nathan**, *p*-cyanobenzyl chloride, A., i, 658.
- Mosso, Ugolino**, temperature of the body during fasting and the speed of assimilation of carbohydrates, A., ii, 605.
- rate of absorption and of assimilation of proteids and fats, A., ii, 605.
- Mosseik, F.** See *Theodor Pfeiffer*.
- Mouillipied, A. T. de.** See *Daniel Vorländer*.
- Mouneyrat, Antoine**, general method for the preparation of halogen derivatives of aliphatic hydrocarbons, A., i, 577.
- conversion of α -amino-acids into phenylhydantoins, A., i, 644.
- Mouneyrat, Antoine**, and *Charles Pourret*, action of bromine on chlorobenzenes in presence of aluminium chloride, A., i, 19.
- Mouneyrat, Antoine.** See also *Emil Fischer*.
- Mouraur, Henri**, action of magnesium on saline solutions, A., ii, 208.
- Mourelo, José Rodriguez**, activity of manganese in promoting the phosphorescence of strontium sulphide, A., ii, 141.
- Mouren, Charles**, catechol derivatives, A., i, 99.
- Mouren, Charles**, and *Raymond Delange*, acetylphenylacetylene and benzoylphenylacetylene, A., i, 397.
- Mrha, Josef**, kelyphite, A., ii, 218.

- Müller, Erich**, formation of hypochlorite and chlorate in the electrolysis of alkali chlorides, A., ii, 73.
 — the discharge potential of chlorine ions, A., ii, 643.
 — apparatus for illustrating the migration and separation of ions, A., ii, 643.
Müller, Friedrich, E. Indian sandalwood oil, A., i, 677.
Müller, Herbert. See *Alfred Werner*.
Müller, Jens. See *Eugen Bamberger*.
Müller, Johannes, and *M. Masuyama*, a diastatic ferment in hens' eggs, A., ii, 420.
Müller, Paul, reduction of cholesterol to coprosterol in the human intestine, A., ii, 289.
 — organic phosphorus in faeces after feeding on milk, A., ii, 422.
Müller, Wolf, change in the transition point of ammonium nitrate at 32° through addition of potassium nitrate, A., ii, 188.
Müller-Thurgau, Hermann, influence of nitrogen on the growth of roots, A., ii, 361.
 — effect of manuring on the inner processes of some plants, A., ii, 506.
Müller von Berneck, R. See *Georg Bredig*.
Münch, A., behaviour of certain artificial hexoses in the animal body, A., ii, 607.
Mugdan, Martin, the lead accumulator, A., ii, 463.
Mukerji, P., detection of free phosphorus, A., ii, 756.
Mulder, Eduard, silver peroxy sulphate and peroxyacetate, A., ii, 724.
Muller, Joseph Auguste, heats of fractional neutralisation of carbonylhydroferrocyanic acid compared with those of hydroferrocyanic acid, A., ii, 130.
Muller, Paul Thiebaut. See *Albin Haller*.
Munk, Immanuel, action of soaps in the body, A., ii, 418.
Munk, Immanuel, and *Max Lewandowsky*, fate of proteids after their introduction into the circulation, A., ii, 154.
Murray, J. Alan, [composition of] weak straw, A., ii, 498.
Murrill, Paul, and *Julius O. Schlotterbeck*, the alkaloids of *Bocconia (Mucleya) cordata*, A., i, 686.
Muspratt, Max, estimation of propionic and butyric acids in acetic acid, A., ii, 375.
Musselius, L., acetylation of primary and secondary amines, A., i, 334.
Musset, Franz, estimation of cornutine, A., ii, 121.
Muthmann, Wilhelm, G. Linck's crystallographic views, A., ii, 533.
Muthmann, Wilhelm, and *E. Baur*, luminescence spectra, A., ii, 544.
 — [purification of] commercial thorium nitrate, A., ii, 597.
Muthmann, Wilhelm, and *R. Böhm*, separation of gadolinite earths, and the preparation of pure yttria, A., ii, 209.
Muthmann, Wilhelm, and *E. Schröder*, cyanoselenium compounds, A., i, 479.
Muthmann, Wilhelm, and *L. Stützel*, spectroscopic analysis of neodymium and of praseodymium, A., ii, 18.
 — preparation of sulphur, chlorine, and bromine compounds of the cerite metals, A., ii, 142.
 — ceric sulphates, A., ii, 544.
Mutschler, L., estimation of oxygen dissolved in water, A., ii, 106.
Myers, Walter, interaction of toxin and antitoxin, A., ii, 558.

N.

- Nabl, Arnold**, hyposulphurous acid, A., ii, 13.
 — colours of minerals, A., ii, 661.
Naef, E. See *Fritz Ullmann*.
Naegeli, Otto, estimation of the acidity of urine, A., ii, 741.
Nagel, Iskar, rancidity of fats, A., i, 271.
Nagelvoort, J. B., assay of opium, A., ii, 777.
Nakaseko, R., glycogen formation after inulin feeding, A., ii, 670.
Nakaseko, R. See also *Lafayette B. Mendel*.
Namias, Rodolfo, volumetric estimation of manganese, A., ii, 50.
Nannes, G., separation in alloys, A., ii, 530.
Napias, Mdle., action of the *Bacillus anthracis* on carbohydrates, A., ii, 493.
Napper, Sidney Scrivener. See *Henry Edward Armstrong*.
Nasini, Raffaele, and *Francesco Anderlini*, waters of Salsomaggiore, A., ii, 489.
Nasini, Raffaele, *Francesco Anderlini*, and *Roberto Salvadori*, new lines in the ultra-red of the argon spectrum, A., ii, 181.
Nasini, Raffaele, and *Roberto Salvadori*, combustible gases of Salsomaggiore, A., ii, 415.

- Nastukoff, A.**, oxycelluloses and the molecular weight of cellulose, A., i, 540.
- Natanson, Ladislaus**, thermokinetic properties of solutions, A., ii, 191.
- Natterer, Konrad**, bronzes from Ephesus, A., ii, 480.
- Neale, H. A.** See **Fred H. Howles**.
- Nef, John Ulric**, tri- and tetra-halogen substituted methanes, A., i, 2.
— dissociation of alkyl salts of nitric acid, sulphuric acid, and the halogen hydrides, A., i, 4.
— phenylacetylene, its salts and halogen substitution derivatives, A., i, 20.
— alkylation of ketones, A., i, 349.
- Nencki, Marcellus**, and **J. Zaleski**, colouring matter of blood, A., i, 709.
- Nerking, Joseph**, can the whole of the glycogen present in an organ be removed by sufficiently long extraction with boiling water? A., ii, 740.
- Nernst, Walther**, electrolytic solution pressure, A., ii, 706.
- Nernst, Walther**, and **F. Dolezalek**, gaseous polarisation in the lead accumulator, A., ii, 641.
- Nessler, Julius**, which meadows should be manured with potash as well as with superphosphate and basic slag? A., ii, 162.
- Neubauer, Hugo**, composition of ammonium magnesium phosphate, A., ii, 108.
— shortened method for estimating potassium in its salts, A., ii, 759.
- Neuberg, Carl**, purification of osazones and estimation of their rotatory power, A., i, 139.
— solubilities of osazones, A., i, 410.
— an optically inactive pentose in urine, A., i, 539.
- Neuberg, Carl**. See also **Paul Mayer** and **Alfred Wohl**.
- Neumann, Albert**, preparation of α - and β -nucleic acids, and of nucleothymic acid, A., i, 319.
— simplification of the phenylhydrazine test for sugar, A., ii, 248.
- Neumann, Edgard**. See **Otto Wallach**.
- Neumann, Max**. See **Alfred Junghahn**.
- Neville, Francis Henry**. See **Charles Thomas Heycock**.
- Newcombe, Frederick C.**, cellulose enzymes, A., ii, 99.
- Newth, George S.**, note on partially miscible aqueous inorganic solutions, T., 775; P., 1900, 87; discussion, P., 88.
— liquefaction of a gas by "self-cooling" (a lecture experiment), P., 1900, 87.
- Nieloux, Maurice**, effect of ingestion of alcohol on the blood of mother and fetus, and on the milk, A., ii, 418.
- Niebel, W.**, oxidation product of glycogen with bromine, A., i, 540.
- Niemensyoki, St.**, three normal butyl-toluenes [methyl-*n*-butylbenzenes], A., i, 636.
- Niementowski, Slesan von**, new homologues of alizarin, hystazarin, and quinizarin, A., i, 450.
- Nietzki, Rudolf**, and **Wilhelm Petri**, constitution of isopurpuric acid, A., i, 485.
- Nikitin, W. W.** See **Eugraph S. von Fedoroff**.
- Nikolaides, R.**, fat in glands during inanition, A., ii, 153.
- Nilson, Lars Fredrik**, Memorial Lecture on (Pettersson), T., 1277; P., 1900, 163.
- Nissenson, H.**, analysis of "Weissmetall," A., ii, 108.
- Nobbe, Friedrich**, and **Lorenz Hiltner**, action of leguminous nodules in water cultures, A., ii, 234.
— how can the action of nitrugin be increased? A., ii, 299.
- Noël-Paton, Diarmid, James Crauford Dunlop**, and **R. S. Aitchison**, metabolism of phosphorus, A., ii, 222.
- Nölting, Emilio**, and **W. Feuerstein**, preparation of phosphorus free from arsenic, A., ii, 722.
- Nörr, Wilhelm**. See **Roland Scholl**.
- Nogin, K. T.** See **Al. A. Shukoff**.
- Nolf, Pierre**, antihæmastic serums, A., ii, 741.
- Noll, Hermann**, estimation of calcium carbonate in marls, A., ii, 48.
- Nolte, S.** See **F. W. Alden**.
- Norden, Konrad**, nature of the process which occurs at the aluminium electrode, A., ii, 404.
- Norman, G. M.** See **F. J. Pond**.
- Normann, W.** See **Wilhelm Meigen**.
- Norris, James F.**, and **Henry Fay**, reduction of selenium dioxide by sodium thiosulphate, A., ii, 272.
- Norris, James F., Henry Fay**, and **D. W. Edgerly**, preparation of pure tellurium, A., ii, 272.
- Norris, James F.**, and **Richard Mommers**, isomorphism of selenium and tellurium, A., ii, 537.
- North, Henry A.** See **Henry Lord Wheeler**.
- Norton, John T., jun.**, titration of mercury by sodium thiosulphate, A., ii, 689.
- Noyes, William Albert**, camphoric acid; synthesis of a camphor derivative, 2:3:3-trimethylcyclopentanone, A., i, 202.

Noyes, William Albert, William Francis Hillebrand, and Charles B. Dudley, report of the [American] committee on coal analysis, A., ii, 168.
Noyes, William Albert, and Edward F. Phillips, camphoric acid. IX. Structure and configuration of *cis-trans*-campholytic acid, A., i, 622.
Nussberger, Gustav, origin of Graubünden mineral waters, A., ii, 90.
Nuvoli, R. See *Mario Zecchini*.

O.

Obermiller, Julius. See *Hans von Peckmann*.
Oddo, Giuseppe, polymerisation of inorganic chloro-anhydrides, A., i, 92.
 — fractional distillation under reduced pressure, A., ii, 131.
Oddo, Giuseppe, and E. Serra, molecular weights of some elements and their derivatives, A., ii, 73.
 — action of arsenious and antimonious oxides on sulphur monochloride, A., ii, 74.
 — polymerisation of inorganic chloro-anhydrides, A., ii, 74.
Oddo, Giuseppe. See also *Alberto Peratoner*.
Oechsner de Coninek, William, allotropy of benzophenone, A., i, 236.
 — stability of sucrose solutions, A., i, 378.
 — solutions of ferric chloride in organic solvents, A., i, 535.
 — isomerism in the aromatic series, A., i, 592.
 — mode of decomposition of metallic chlorides, A., ii, 485, 543.
 — solubility of cupric chloride in organic media, A., ii, 542.
Oechsner de Coninek, William, and E. Derrien, new derivatives of benzophenone, A., i, 502.
Oehmichen, H., auriferous cobalt ores in the Transvaal, A., ii, 147.
Oenslager, George. See *Henry Barker Hill*.
Oesterle, O. A., aloë-emodin and frangula-emodin, A., i, 304.
Oesterlin, Carl. See *Alfred Wohl*.
Oetling, C. F. W. A., solidification of fused silicates under high and normal pressures, A., ii, 149.
Oettingen, Helmuth von, decomposition of sodium thiosulphate by acids, A., ii, 400.
Offer, Theodor Rob., and Sigmund Fränkel, behaviour of chitosamine [glucosamine] hydrochloride in the animal organism, A., ii, 294.

Offergeld, Heinrich. See *Bernhard Schöndorff*.
Ogawa, Masataka. See *Edward Divers*.
Ogston, George Henry, obituary notice of, T., 594.
Oilar, Rozier D., the Halphen colour test and its value for the detection of cotton seed oil, A., ii, 772.
Oker-Blom, Max., chemico-physical relations of animal juices and tissues, A., ii, 290, 356, 607.
 — effect of suspended particles on conductivity, A., ii, 331.
Oliveri-Tortorici, Riccardo, ethyl dimethylpyrinedicarboxylate, A., i, 552.
 — action of nitrogen tetroxide on quinonedioximes, A., i, 553.
 — researches in the pyrone group. VIII. Diethyl comenate, A., i, 587.
Ollendorff, Gerhard. See *Otto Ruff*.
Olshowy, Julius, flax, A., ii, 500.
Olsen, J. C. See *Harmon Northrup Morse*.
Olsewski. See *Carl Adam Bischoff*.
Omelianaky, V., nitrification of organic nitrogen, A., ii, 97.
 — magnesia-gypsum as a solid medium for the cultivation of nitrifying organisms, A., ii, 232.
 — fermentation of cellulose, A., ii, 493.
Omelianaky, V. See also *Sergei Winogradsky*.
Oppenheimer, Carl, detection of acetone in urine and other animal secretions, A., ii, 180.
Oppenheimer, Max. See *Alfred Einhorn*.
Ordonneau, Charles, malates and tartromalates, A., i, 203.
 — [estimation of calcium malate in crude tartar], A., ii, 250.
Orndorff, William Ridgely, and C. E. Brewer, gallein and cerulein, A., i, 447.
Orndorff, William Ridgely, and D. A. Morton, anethole and its isomerides, A., i, 289.
Orndorff, William Ridgely, and F. A. Richmond, phenylthiocarbimide as a reagent for the detection of the alcoholic hydroxyl group, A., i, 156.
Ornstein, Fritz, water of crystallisation in the calcium and barium salts of γ -methylvaleric (isohexic) acid, A., i, 7.
Orsa, I. See *Eugen Bamberger*.
Ortoleva, Giovanni, action of iodine on a pyridine solution of malonic acid, A., i, 558.
 — preparation of iodoso- and iodoxy-derivatives, A., i, 592.

Ortoleva, Giovanni. See also *Gastano Minunni*.

Orton, Kennedy Joseph Previte, and *Waller Lionel Blackman*, estimation of hypiodites and iodates, and the reaction of iodine monochloride with alkalis, T., 880; P., 1900, 103; discussion, P., 104.

Orton, Kennedy Joseph Previte. See also *Frederick Daniel Chattaway*.

Osborne, Thomas Burr, and *George F. Campbell*, nucleic acid of the embryo of wheat and its protein compounds, A., i, 573.

— proteid constituents of egg white, A., i, 574.

— proteids of the egg yolk, A., i, 616.

Osborne, W. A. Hüfner's method of preparing pure glycocholic acid, A., ii, 419.

Osborne, W. A., and *Swoale Vincent*, physiological effects of extracts of nervous tissues, A., ii, 423.

Oslan, Lazar. See *Heinrich Goldschmidt*.

Osswald, Gustav. See *Arthur Hantzsch*.

Ost, Hermann, and *W. Klapproth*, electrolytic precipitation of antimony from its sulpho-salt with the application of a diaphragm, A., ii, 692.

Osterberg, Emil. See *Francis Gano Benedict*.

Ostwald, Wilhelm, oxidations with free oxygen, A., ii, 592.

— supposed isomerism of red and yellow mercuric oxide, and the surface tension of solid bodies, A., ii, 712.

— periodic phenomena in the dissolution of chromium in acids, A., ii, 730.

Ostwald, Wilhelm. See also *Hans Landolt*.

O'Sullivan, James, presence of invertase in some plants of the Gramineæ, I., T., 691; P., 1900, 61.

— rate of alcoholic fermentation, A., ii, 230.

Oswald, Ad., chemistry and physiology of the thyroid, A., ii, 358.

Ottemann, L. See *Otto Wallach*.

Otto, Richard, manurial experiments with vegetables, A., ii, 753.

Oui. See *E. Derodis*.

Ouvard, Léon [Victor Rend], metallic borates, A., ii, 206.

— borates of zinc, manganese, nickel, and cobalt, A., ii, 207.

Oxland, Robert, obituary notice of, T., 595.

P.

Paal, Carl, glutinpeptone hydrobromide and hydriodide, A., i, 467.

Paderi, Cesare, relationship between chemical constitution and physiological action. I. Physiological action of alkalies of piperidine, A., ii, 742.

Paessler, analysis of tannin materials, A., ii, 457.

Pagel, C., preparation of double sulphates of chromium, A., ii, 349.

Pagel, C. See also *Charles Frédéric Schlagdenhauffen*.

Pagnoul, Aimé, how much phosphoric acid should good arable soils contain? A., ii, 164.

— [estimation of the available phosphoric acid in soils], A., ii, 167.

— effect of rain and of the nature of the soil on the production of crops, A., ii, 306.

Paira-Mall, L., digestion in birds, A., ii, 553.

Paix-Séailles, C. See *Ernest Charon*.

Paliatzeas, Photios G. See *Walter Noel Hartley*.

Palladin, Wladimir, conditions of the production of proteids insoluble in gastric juice and their importance for the respiration of plants, A., ii, 612.

Palmaer, Wilhelm, a simple protection for fused-in platinum wires, A., ii, 8.

Palomaa, H., preparation of ethyl-dichloroamine, A., i, 143.

Pannertz, F., improvement in Péligot's absorption apparatus for ammonia estimations, A., ii, 621.

Panormoff, Alexei A., nomenclature of the albumins of white of egg, A., i, 126.

— action of heat, dilute acids, and alcohol on albumin, A., i, 127.

— action of heat, dilute acids, and alcohol on albumin, A., i, 571.

— action of dilute acids, alcohol, and heat on columbinin, A., i, 709.

Panzer, Theodor, ovarian colloid, A., i, 70.

— cerebro-spinal fluid, A., ii, 152.

— human chyle, A., ii, 672.

Panzer, Theodor. See also *Ernst Ludwig*.

Papastavros, Stavros C. See *Alfred Einhorn*.

Pappadà, N. See *Giuseppe Bruni*.

Paria, Giulio, bat guano found at Cagliari, Sardinia, A., ii, 106.

— hundertkräuter-Likör (Centerba), A., ii, 446.

— detection of fluorine in wine, A., ii, 572.

- Parker, A. Hyde.** See *Charles George Matthews*.
- Parker, F. H.,** and *Graham Lusk*, the maximum production of hippuric acid in rabbits, A., ii, 419.
- Parker, William H.,** xanthine bases in feces, A., ii, 556.
- Parker, William H.** See also *Benjamin Moore*.
- Parmentier, F.,** and *A. Hurion*, gases evolved by the springs of Mont Dore, A., ii, 415.
- Parr, Samuel Wilson,** a new coal calorimeter, A., ii, 710.
- new volumetric method for the estimation of copper, A., ii, 762.
- Partheil, Alfred,** and *A. Gronover*, action of triethylphosphine on *ω*-dibromo-*o*-xylene, A., i, 368.
- morphine, A., i, 516.
- Partheil, Alfred,** and *A. van Haaren*, influence of the amount of water on the specific rotation of alcoholic solutions of camphor; valuation of spirit of camphor, A., i, 507, 580.
- mercury phosphide and phosphonium compounds, A., ii, 543.
- Partheil, Alfred,** and *E. Mannheim*, mercury antimonide and stibonium compounds, A., i, 479; ii, 543.
- Partheil, Alfred,** and *J. von Velsen*, refractometric butter analysis, A., ii, 633.
- Passerini, Napoleone,** composition of the branches of pear trees removed by regular thinning, A., ii, 162.
- gummy substances in elm galls, A., ii, 427.
- Passon, Max,** estimation of calcium by the citrate method, A., ii, 246.
- Patein, Gustave,** compounds of diantipyrimethane (formopyrine), A., i, 530.
- Patein, Gustave,** and *Emile Dufan*, estimation of sugar in diabetic urine, A., ii, 176.
- Paternò, Emanuele,** constitution of usnic acid, A., i, 662.
- Patterson, T. S.** See *John McCrae*.
- Pattinson, John,** and *Hugh Salvin*, estimation of manganese as sulphide, A., ii, 443.
- Paul.** See *Wilhelm His, jun.*
- Pauli, W.,** physical alterations in proteids, A., i, 265.
- Pauly, Hermann,** and *Carl Boehm*, action of amines on dibromotriacetoneamine, A., i, 357.
- Pauly, Hermann,** and *Hans Lieck*, mesityl oxide, A., i, 274.
- Pawlewski, Bronisław,** solubility of sodium tungstate in water, and the density and refractive indices of its solutions, A., ii, 400.
- Peachey, Stanley John.** See *William Jackson Pope*.
- Pearce, F.** See *Louis Duparc*.
- Pease, H. C.,** electrochemical equivalent of carbon, A., ii, 257.
- Péchar, E.,** combination of metallic iodides with sulphur dioxide, A., ii, 398.
- action of oxidising agents on alkali iodides, A., ii, 536.
- Pechmann, Hans von,** coumarins, I., A., i, 173.
- action of diazomethane on picryl acetate, A., i, 313.
- Pechmann, Hans von,** and *Otto Ansel*, vinylideneoxanilide and its homologues, A., i, 287.
- hydroxyethylideneoxanilide, A., i, 389.
- Pechmann, Hans von,** and *Wilhelm Bauer*, dihydro-1:2:3:4-tetrazine (osotetrazine), A., i, 314.
- Pechmann, Hans von** [with *Julius Obermiller*], decomposition of benz-enylmethyliminocchloride, A., i, 294.
- Pechmann, Hans von,** and *Max Schaal*, coumarins. II. 7-Dimethylamino-4-methylcoumarin and homologues, A., i, 178.
- Pechmann, Hans von,** and *Otto Schwarz*, coumarins. III. 7-Amino-4-methylcoumarin, A., i, 174.
- coumarins. IV. Action of *m*-aminophenol on ethyl acetoacetate, A., i, 174.
- Peckham, Stephen Farnum,** and *H. E. Peckham*, estimation of sulphur in bitumens, A., ii, 44.
- Peckham, Stephen Farnum.** See also *O. H. Klein*.
- Pélabon, H.,** chemical equilibrium in a system of four gases, A., ii, 265.
- action of hydrogen on mercury selenide, and the inverse action, A., ii, 346.
- action of hydrogen on antimony sulphide, A., ii, 352.
- action of hydrogen on the sulphides of arsenic, A., ii, 652.
- Pelikan, A.,** pyroxene from Moravia, A., ii, 662.
- Pellegrin, Michel,** Fittig's reaction, A., i, 151.
- Pellet, Henri,** estimation of sugar in urine, A., ii, 113.
- influence of lead acetate and basic acetate on the estimation of reducing sugars in wines and lees, A., ii, 113.
- Pellini, G.** See *Roberto Salvadori*.
- Penfield, Samuel Lewis,** graftonite, a new mineral, A., ii, 216.

- Penfield, Samuel Lewis**, composition of sulphohalite, A., ii, 550.
 — interpretation of mineral analyses; constitution of tourmaline, A., ii, 602.
- Penfield, Samuel Lewis**, and **Charles Hyde Warren**, new minerals from Franklin, New Jersey, A., ii, 88.
- Pennington, Mary E.**, and **George C. Kisel**, gas-producing power of *Bacillus coli communis* under different conditions of environment, A., ii, 678.
- Penny, Charles L.**, a multiple fat extractor, A., ii, 770.
- Peratoner, Alberto**, and **G. Leonardi**, pyrone group. VI. Constitution of meconic, comenic, and pyromeconic acids, A., i, 550.
 — pyrone group. VII. A condensation product of acetylcarbinol, A., i, 551.
- Peratoner, Alberto**, and **Giuseppe Oddo**, electrolysis of azoimide, A., ii, 651.
- Perdrix, Léon**, oxidation of dibasic acids of the aliphatic series by acid potassium permanganate, A., i, 582.
- Peritz**. See **Spiegel**.
- Perkin, Arthur George**, apiin and apigenin. Part II. Note on vitexin, T., 416; P., 1900, 44.
 — yellow colouring principles contained in various tannin matters. Part VII. *Arctostaphylos Uva ursi*, *Hæmatoxylon Campeachianum*, *Rhus Metopium*, *Myrica Gale*, *Coriaria myrtifolia*, and *Robinia Pseudacacia*, T., 423; P., 1900, 45.
 — luteolin, III., P., 1899, 242.
- Perkin, Arthur George**, and **Louis Herbert Horsfall**, genistein. Part II., T., 1810; P., 1900, 182.
 — luteolin. Part III., T., 1814; P., 1900, 181.
- Perkin, William Henry**, refractive and magnetic rotatory powers of some benzenoid hydrocarbons; refractive powers of mixtures; improved spectrometer scale reader, T., 267; P., 1899, 237; discussion, P., 238.
- Perkin, William Henry, jun.**, and **Jocelyn Field Thorpe**, experiments on the synthesis of camphoric acid. III. The action of sodium and methyl iodide on ethyl dimethylbutanetricarboxylate, P., 1900, 152.
- Perkin, William Henry, jun.**, **Jocelyn Field Thorpe**, and **C. Walker**, a new series of pentamethylene derivatives, I., P., 1900, 149.
- Perkin, William Henry, jun.**, and **J. Yates**, on hæmatoxylin, V., P., 1900, 107.
- Perkin, William Henry, jun.** See also **J. Frank Bottomley**, **N. E. Bowtell**, **Alexander William Gilbody**, and **Frederick H. Lees**.
- Perkins, Bryan W.** See **John Theodore Hewitt**.
- Perman, Edgar Philip**, and **G. A. S. Atkinson**, vapour density of bromine at high temperatures, A., ii, 398.
- Perrier, Gustave**, function of aluminium chloride in the Friedel-Crafts' reaction, A., i, 331.
 — anthraphenones, A., i, 350.
 — essence of chrysanthemum, A., i, 352.
- Peschke, M.** See **Georg Schroeter**.
- Pescl, Leone**, organo-mercury compounds of benzoic acid, A., i, 546.
- Petermann, E.** See **Theodor Zinke**.
- Peters, C. A.**, separation and estimation of mercury as mercurous oxalate, A., ii, 576.
- Peters, C. A.** See also **Frank Austin Gooch**.
- Peters, H.** See **Oscar Kellner**.
- Peters, Harold**. See **Frederic Stanley Kipping**.
- Petersen, Julius**, electrolysis of the alkali salts of organic acids, A., ii, 522.
- Petersen, Theodor**, [turquoise and phosphorochalcite], A., ii, 661.
- Petit, Paul**, dextrins of saccharification, A., i, 589.
- Petit, Paul**, and **G. Labourasse**, dissolution of the nitrogenous compounds in malt, A., ii, 611.
 — nitrogenous substances in malt, A., ii, 680.
- Petrenko-Kritschenko, Pavel Iv.**, hydroxylamine derivatives of tetrahydropyrone compounds, A., i, 306.
 — configuration of saturated fatty compounds, A., i, 421.
- Petrenko-Kritschenko, Pavel Iv.**, and **E. Eltchaninoff**, synthesis of tetrahydropyrone derivatives, A., i, 307.
- Petrenko-Kritschenko, Pavel Iv.**, and **P. Kasanesky**, ketoximes, A., i, 350.
- Petri, Wilhelm**. See **Rudolf Nietzki**.
- Petry, Eugen**, loosely combined sulphur in the urine, A., ii, 675.
- Pettersson, Otto**, Nilson Memorial Lecture, T., 1277; P., 1900, 163.
- Pfaundler, Meinhard**, end products of gastric digestion, A., ii, 666.
 — estimation of amino-acid nitrogen in urine, A., ii, 674.
- Pfeiffer, Hermann**. See **Alfred Einhorn**.
- Pfeiffer, Otto**, estimation of benzene vapour in illuminating gas, A., ii, 173.
- Pfeiffer, Paul**, tripyridinechromium trichloride and triethylenediaminechromium salts, A., i, 559.

- Pfeiffer, Paul**, additive compounds formed by nitriles with tripyridine-chromium trichloride: dithiocyanodithylenediaminechromium salts, A., i, 688.
- Pfeiffer, [Franz Wilhelm] Theodor [Christian]**, metabolism in horses, A., ii, 554.
- effect of different potassium salts on the composition and yield of potatoes, A., ii, 751.
- Pfeiffer, Theodor, F. Mozeik, and Otto Lemmermann**, methods of experiments on the preservation of farmyard manure, A., ii, 753.
- Pfäfer, Eduard [Friedrich Wilhelm]**, influence of the kind and amount of nutriment on metabolism, A., ii, 91.
- origin of fat from proteid, A., ii, 92.
- energy-value of flesh and proteid, A., ii, 417.
- use of horse-flesh as food, A., ii, 490.
- estimation of glycogen, A., ii, 581.
- absorption of coloured fats, A., ii, 667.
- Pförringer, S.**, autodigestion of the pancreas, A., ii, 28.
- Pfyl, Balthasar**. See *Alfred Einhorn*.
- Phillips, Alexander Hamilton**, trap-rock of Rocky Hill, New Jersey, A., ii, 27.
- Phillips, Edward F.** See *William Albert Noyes*.
- Piccinini, Antonio**, an alkaloid contained in the bark of the pomegranate, A., i, 110.
- optical properties of granatan- and tropae-nuclei, A., i, 249.
- Piccinini, Antonio, and L. Salmoni**, 2-pyrrylurethane, A., i, 562.
- Pick, Ernst P.**, products of the peptic digestion of fibrin, A., i, 68.
- Pickard, Robert Houston**. See *Johannes Thiele*.
- Pictet, Amé**, reduction of nicotine to i-nicotine, A., i, 685.
- Pictet, Amé, and B. Athanasescu**, laudanosiue, A., i, 685.
- Pictet, Amé, and A. Rotschy**, i-nicotine, A., i, 685.
- Piepes-Poratyński, Jan**, polymerisation of p-toluenitrile, A., i, 648.
- Pierallini, Galileo**, [glycolytic action of the pancreas and of urine], A., ii, 420.
- alimentary oxaluria, A., ii, 492.
- Pilshay, Benjamin M.**, comparison of some tests for formaldehyde, A., ii, 453.
- Pinner, Adolf**, pyridinecarboxylic acids, A., i, 409.
- compounds of bromal with formaldehyde, A., i, 427.
- Pinner, Adolf, and Erich Kohlhammer**, pilocarpine, A., i, 456, 685.
- Pinner, Adolf, and J. Lewin**, 2-methylpyridine-6-carboxylic acid, A., i, 409.
- Pinnow, Johannes**, acetylation with acetic anhydride in aqueous solution, A., i, 214.
- Platti, Giuseppe**, jadeite from Piedmont, A., ii, 487.
- Pissarjewsky, L.**, thermochemistry of hyper-acids, A., ii, 466.
- Pitra, J.** See *Julius Stoklassa*.
- Pitsch, M.** See *August Michaelis*.
- Plancher, Giuseppe**, [and in part *Aldo Bonavia*], action of alkyl iodides on indoles, A., i, 560.
- Plancher, Giuseppe**, [with *Giuseppe Testoni*], transformations of tetrahydrocarbazole, A., i, 562.
- Plavec, W.**, action of the blood-gases on breathing, A., ii, 288.
- Plimpton, Richard Tayler**, obituary notice of, T., 595.
- Plot, J.**, estimation of the phosphoric acid available as plant food in soils and manures, A., ii, 510.
- Plotnikoff, W.** See *Michael I. Konovaloff*.
- Poda, Heinrich, and Wilhelm Fraunfels**, plasmon, A., ii, 289.
- Poduschka, R.**, estimation of allantoin in urine, A., ii, 636.
- Pokrovsky, Aristarch**, β -methylethylhydracrylic and β -methylethylacrylic acids, A., i, 328.
- Polacco, R.** See *Alexander Tschirch*.
- Pollaci, Gino**, presence of formaldehyde in plants, A., ii, 160.
- assimilation by means of chlorophyll, A., ii, 426.
- Pollak, Jacques**. See *Josef Herzig, and Hugo Weidel*.
- Polledro, Oreste**. See *Alberico Benedicenti*.
- Pollok, James Holms**, kieselguhr from Co. Antrim, A., ii, 287.
- Pomeranz, Caesar**, velocity of the reaction between sodium hydroxide and benzaldehyde, A., i, 552.
- Pommerehne, Herbert**, damascenine, a constituent of the seeds of *Nigella damascena*, L., A., i, 684.
- Pond, F. J., O. P. Maxwell, and G. M. Norman**, action of sodium methoxide on dibromides of propenyl compounds and of unsaturated acids, A., i, 102.
- Poni, Petru**, composition of Roumanian petroleum, A., i, 617.
- Ponsot, A.**, cryoscopy of Tanret's rhamnose and rhamnitrionic acid, A., i, 333.

- Ponsot, A.**, chemical reactions in solution; vapour tension of the solvent, A., ii, 337.
 — limited chemical reactions in homogeneous systems; modulus law, A., ii, 392.
- Ponzio, Giacomo**, conversion of ketones into α -diketones. V. *iso*Propyl*isobutyl* ketone, A., i, 588.
 — acetyldioximes of α -diketones, A., i, 588.
- Pool, J. F.**, new method for estimating nitric acid, A., ii, 107.
- Pope, Frederick J.**, magnetic iron ores from Eastern Ontario, A., ii, 409.
- Pope, Thomas Henry**. See *Julian Levett Baker*.
- Pope, William Jackson**, and *Alfred William Harvey*, racemisation occurring during the formation of benzylidene, benzoyl, and acetyl derivatives of *d-ac*-tetrahydro- β -naphthylamine, P., 1900, 74.
- Pope, William Jackson**, and *Stanley John Peachey*, asymmetric optically active sulphur compounds; *d*-methyl-ethylthetine platinumchloride, T., 1072; P., 1900, 12.
 — asymmetric optically active tin compounds; *d*-methylethyl-*n*-propyl tin iodide, P., 1900, 42.
 — the racemisation of optically active tin compounds: *d*-methylethyl-propyl tin *d*-bromocamphorsulphonate, P., 1900, 116; discussion, P., 117.
- Poquillon, F.**, rapid method for the estimation of clay in soils, A., ii, 316.
- Posner, Theodor**, disulphones. III. Mercaptols and disulphones of ketonic acids, and unsaturated acids derived therefrom, A., i, 5.
- Posner, Theodor**, and *Johannis Fahrenhorst*, disulphones. II. Aminosulphonals and its derivatives and homologues, A., i, 16.
- Possetto, Giovanni**, rapid estimation of sugar in fatty substances, A., ii, 176.
- Posternak**, phosphorus compound first formed in chlorophyllous plants; physiological rôle of inositol, A., ii, 679.
- Pottevin, Henri**, isomaltose, A., i, 77.
 — saccharification of starch, A., i, 80.
 — maltodextrin, A., i, 81.
- Potts, J. P.** See *Alexander K. Miller*.
- Pouget, Isidore**, thio- and seleno-antimonites, A., ii, 84.
- Pouret, Charles**, bromination by means of aluminium bromide, A., i, 369.
- Pouret, Charles**. See also *Antoine Mouneyrat*.
- Powell, Norman S.** See *Joseph W. Richards*.
- Power, Frederick B.**, and *Frank Shedd*, composition and estimation of cerium oxalate, A., ii, 628.
- Pozzi-Escot, M. E.**, new microchemical reactions of copper, A., ii, 207.
- Pozzi-Escot, M. E.**, and *H. C. Couquet*, new microchemical reaction of palladium, A., ii, 371.
 — microchemical researches on yttrium, erbium, and didymium, A., ii, 404.
- Pratt, Joseph Hyde**, [chabazite] from North Carolina, A., ii, 24.
- Prause, H.** See *Rudolph F. Weinland*.
- Fraunhofer, Wilhelm**. See *Heinrich Poda*.
- Preston, H. L.**, Illinois Gulch meteorite, A., ii, 287.
 — two new American meteorites, A., ii, 355.
 — meteorite from Oakley, Kansas, A., ii, 552.
- Preuss, Hugo**. See *Martin Freund*.
- Preuss, L.**, and *A. Bins*, preparation of anthranilic acid from *o*-nitrotoluenes, A., i, 392.
- Priganschnikoff, Dmitri N.**, regeneration of proteids from their products of decomposition, A., ii, 233.
 — vegetation experiments in 1897, A., ii, 237.
- Pfibrum, Richard**, austrium, A., ii, 347.
- Price, Thomas Slater**, temperature coefficient of ester hydrolysis, A., ii, 528.
- Priest, Martin**. See *Cresacre G. Moor*.
- Prior, Eugen**, and *D. Wiegmann*, preparation and properties of diastase-schroodextrin III., A., i, 541.
- Prior, George Thurland**, the hamlinite-florencite group of minerals, A., ii, 602.
- Prior, George Thurland**, and *Leonard James Spencer*, identity of binnite with tennantite, A., ii, 21.
- Prior, George Thurland**. See also *Eugen Hussak*.
- Přilowski, Eduard**, parting of gold-platinum alloy, A., ii, 111.
- Pröschner, Fr.**, precipitation of dyes by ammonium persulphate, A., i, 454.
 — acetophenoneazobilirubin, A., i, 571.
- Proppe, A.** See *Theodor Curtius*.
- Prosin, M.** See *Alexander P. Sabanoff*.
- Prost, Eugene**. See *Jacques Cavalier*.
- Prud'homme, Maurice**, new method of methylation, A., i, 244.
 — new colouring matter of acid function, A., i, 455.
 — new blue colouring matter, fast to alkalis, A., i, 455.
- Prunier, L. Léon A.**, general observations on "emetics," A., i, 376.

- Prunier, L. Léon A.**, and **Adolphe Jouve**, preparation of monocalcium phosphate, A., ii, 140.
- Pechorr, Robert**, syntheses in the phenanthrene series; ψ -thebaol, A., i, 233.
- Pechorr, Robert**, and **Walter Buckow**, synthesis of 2:3-dimethoxyphenanthrene, A., i, 489.
- Pechorr, Robert**, and **Bernhard Jaeckel**, synthesis of 4-hydroxyphenanthrene, A., i, 488.
- Pechorr, Robert**, and **C. Sumuleanu**, o-nitrovanillin, A., i, 178.
- synthesis of dimethylmorphol, and of isomethylmorphol, A., i, 487.
- Pechorr, Robert**, and **O. Wolfes**, isomeric change of o-amino- and o-nitro-cinnam-onitriles, A., i, 170.
- Pechorr, Robert**, **O. Wolfes**, and **Walter Buckow**, syntheses in the phenanthrene series; synthesis of 1- and 3-methoxyphenanthrene, A., i, 232.
- Piaux**. See **Rösser**.
- Pucciatti, L.**, liquid absorption spectra in the ultra-red, A., ii, 585.
- Purinton, C. O.** See **Benjamin Moore**.
- Pushin, N. N.** See **Wetochiaslaw E. Tistschenko**.

Q.

- Quayle, W. O.** See **Charles Frederic Mabery**.
- Quinke, Friedrich**, electrolysis of fused salts, A., ii, 644.

R.

- Raab, Oscar**, action of fluorescent substances on Infusoria, A., ii, 425.
- Raalte, A. van**, phenyl- and p-chlorophenyl-nitromethane, A., i, 147.
- Rabaut, Charles**, hydrolysis of benzonitrile, A., i, 170.
- Rachford, Benjamin Knox**, influence of bile, of acid, and of alkalis on the proteolytic action of pancreatic juice, A., ii, 91.
- Radais, Maxime**, pure culture of a green Alga; formation of chlorophyll in the dark, A., ii, 362.
- Ragland, C. D.**, double halogen salts of cadmium with the methylamines and tetramethylammonium, A., i, 141.
- Raikow, P. N.**, double compounds of aromatic aldehydes and esters with orthophosphoric acid, A., i, 602.
- lecture experiments for demonstrating fractional distillation, A., ii, 648.
- Halphen's colour reaction for the identification of cotton seed oil, A., ii, 698.
- Raikow, P. N.**, and **P. Schtarbanow**, testing antipyrine for antifebrin, phenacetin, and exalgin, A., ii, 456.
- Raikow, P. N.**, and **N. Tschernewiwanow**, Bechi and Halphen's colour reactions for the identification of cotton seed oil, A., ii, 252.
- Rainy, H.**, action of diphtheria toxin on the motor cells of the spinal cord, A., ii, 557.
- Raken, H.** See **Ernst Cohen**.
- Ramberg, Ludwig**, action of bromine on phenylsulphonacetic acid and α -phenylsulphonpropionic acid in aqueous solution; a contribution to chemical kinetics, A., ii, 717.
- Ramm, Eberhard**, feeding cows with cane sugar, A., ii, 749.
- feeding cows with maize gluten, A., ii, 749.
- feeding cows with malt-germ molasses, A., ii, 749.
- Ramm, Eberhard**, and **W. Mintrop**, determination of the action of some new foods on the secretion of milk, with special reference to the amount of fat in the rations formed with these foods, A., ii, 39.
- Ramm, Eberhard**, and **E. Möller**, experiments on feeding cows with brewery residues, A., ii, 104.
- feeding cows with English cake, A., ii, 508.
- feeding cows with bassia nut and palm-bassia cake, A., ii, 508.
- feeding cows with tropon, A., ii, 508.
- Ramm, Eberhard**, and **C. Momsen**, non-saccharine matter contained in molasses, A., ii, 750.
- Ramsay, William**. See **Julien Draggman**.
- Ransom, F.**, diphtheritic paralysis and antitoxin, A., ii, 557.
- the lymph after intravenous injection of tetanus toxin and antitoxin, A., ii, 558, 608.
- Ransom, James H.**, molecular re-arrangement of o-aminophenyl ethyl carbonate to α -hydroxyphenylurethane, A., i, 218.
- Ransome, F. Leslie**. See **William Francis Hillebrand**.
- Raschig, Fritz**, estimation of m-cresol in mixtures of cresols, A., ii, 694.
- Rath, W.** See **Otto Wallach**.
- Rauwerda, A.**, cytosine and its alkyl derivatives, A., i, 607, 684.
- Rây, Prafulla Chandra**, interaction of mercurous nitrite and ethyl iodide, P., 1899, 239.
- mercurous iodide, P., 1899, 239.

- Rayleigh, John William Strutt** [Lord], passage of argon through thin films of indiarubber, A., ii, 342.
- weight of hydrogen desiccated by liquid air, A., ii, 589.
- viscosity of argon as affected by temperature, A., ii, 590.
- Raymond, Rossiter Worthington**, limonite pseudomorphs from Dutch Guiana, A., ii, 86.
- Reach, Felix**, amount of tyrosine from proteids, A., i, 126.
- Read, Harold M.** See *Wyndham Rowland Dunstan*.
- Reade, T. Mellard, and Philip Holland**, phyllades and slates, A., ii, 150.
- Reeb, Moritz**, active constituents of the wallflower, A., i, 186.
- Regelsberger, Friedrich** [Ferd.], recovery of chromic acid from chromium residues, A., ii, 79.
- Reichard, C.**, estimation of manganic acids in the presence of manganese salts or of both manganese compounds in presence of each other by means of an alkaline solution of arsenious acid, A., ii, 109.
- detection of iodic acid in the presence of chloric acid, bromic acid, perchloric acid, and periodic acid by means of morphine sulphate, A., ii, 685.
- volumetric estimation of chromic acid by arsenious acid in an alkaline solution, A., ii, 691.
- Reicher, Lodewyk Theodorus.** See *W. P. Jorissen*.
- Reinders, W.**, mixed crystals of mercuric iodide and bromide, A., ii, 70.
- equilibrium between lead and zinc, and mixtures of their fused chlorides, A., ii, 715.
- alloys of antimony and tin, A., ii, 731.
- Reinganum, Max**, equation of condition, A., ii, 135.
- Reinsch, A., and H. Lüthrig**, variation in milk solids; control of milk supply, A., ii, 771.
- Remington, J. S.** See *Charles Frederick Cross*.
- Reswjakoff.** See *Nicolai N. Ljubavin*.
- Reverdin, Frédéric, and Pierre Crépieux**, 4:1-chloronaphthylamine, A., i, 288.
- nitration of *m*-chlorotoluene, A., i, 638.
- chlorination of aceto-*m*-tolu-*idide*, A., i, 644.
- influence of the orientation of chromophores on the colour and other properties of dyes, A., i, 701.
- Reverdin, Frédéric, and F. Eckhard**, chloroanisidines and chloroanisole, A., i, 28.
- Rey, Hermann**, the number of isomeric naphthalene derivatives, A., i, 482.
- Reyohler, Albert**, thermochemical law of maximum work, A., ii, 258.
- Reynolds, Henry Charles**, obituary notice of, T., 596.
- Reynolds, James Emerson**, researches on silicon compounds. Part VI. On silicodiphenyldiimide and silicotriphenylguanidine, T., 836; P., 1900, 133.
- Rey-Pailhade, Joseph de**, chemical fermentation by yeast in an antiseptic medium, A., ii, 678.
- Riban, Joseph**, new gasometer of constant pressure, adjustable at will, A., ii, 340.
- Richard, E.**, compounds of bismuth with phenols, A., i, 593.
- Richards, A. N.** See *William J. Gies*.
- Richards, Joseph W., and Norman S. Powell**, substitutes for hydrochloric acid in testing carbonates, A., ii, 440.
- Richards, Theodore William**, relation of the taste of acids to their degree of dissociation, A., ii, 391.
- estimation of sulphuric acid in the presence of iron; solid solution and the hydrolysis of chromium and iron salts, A., ii, 472.
- the "driving tendency" of physico-chemical reaction and its temperature coefficient, A., ii, 533.
- method for testing weights, A., ii, 534.
- Richards, Theodore William, and Gregory Paul Baxter**, atomic weight of cobalt. III. Analysis of cobaltous chloride and oxide, A., ii, 78.
- revision of the atomic weight of iron, A., ii, 407.
- Richards, Theodore William, Edward Collins, and George W. Heimrod**, electrochemical equivalent of copper and silver, A., ii, 256.
- Richardson, Frederic W., and Adolf Jaffé**, water-softening (or so-called "scouring") power of soaps, A., ii, 326.
- Richardson, George M., and Maxwell Adams**, double halogen salts of tin with organic bases, A., i, 151.
- Richaud, A., and R. Bonneau**, analysis of the liquid contained in a mesenteric cyst, A., ii, 557.
- Richmond, F. A.** See *William Ridgely Orndorff*.
- Richmond, Henry Droop**, composition of milk and milk products, A., ii, 696.

- Richmond, Henry Droop**, and **J. Bristowe** - **P. Harrison**, sour milk, A., ii, 451.
- Richter, Otto**. See **Richard Stoermer**.
- Richter, R.** See **Hermann Thiele**.
- Richter, W.** See **Karl Auwers**.
- Rideal, Samuel**, and **A. G. R. Foulerton**, boric acid and formaldehyde as milk preservatives, A., ii, 560.
- Ridenour, W. E.**, soluble ferric pyrophosphate, A., ii, 444.
- Riechelmann, Rudolf**, estimation of ferrocyanide in spent gas purifying material, A., ii, 111.
- Riederer, Emil J.**, electrolytic estimation of zinc in presence of manganese, A., ii, 49.
- Riegler, E.**, estimation of carbolic acid and other phenols, A., ii, 112.
- Riemer, Adolf**, estimation of sulphur in pig- and cast-iron, A., ii, 309.
- Rigot, A.** See **Louis Meunier**.
- Riiber, C. N.**, apparatus for sublimation, A., ii, 468.
- Riiber, C. N.** See also **Carl Liebermann**.
- Riiber, Severin H. R.** See **Leo Grünhut**.
- Rimatori, Carlo**, chabazites from Sardinia, and from the granulites of Striegau, Silesia, A., ii, 735.
- Rimini, Enrico**, isocamphor, A., i, 554.
- researches in the camphor group, A., i, 555.
- new reaction of acetone and a new method for the detection of aliphatic amines, A., ii, 56.
- colour reaction of acetaldehyde, II., A., ii, 454.
- Rinne, Friedrich**, nature of water of crystallisation, A., ii, 202.
- Ripper, Maximilian**, chemistry and analysis of wines, A., ii, 319.
- Ris, Cristoph**, sulphur derivatives from *p*-aminophenol and hydroxyazobenzene, A., i, 419.
- Robertson, J.** See **Paul Duden**.
- Robey, W. H., jun.** See **Harold C. Ernst**.
- Rocques, Xavier**, polarimetric estimation of sugar in wine, A., ii, 695.
- Rodewald, Hermann**, "swelling" (Quellung) and wetting, A., i, 477.
- Rodewald, Hermann**, and **A. Kattein**, preparation of starch solutions and separation of starch granules from such solutions, A., i, 79.
- specific heat of wheat starch as a function of hydration and temperature, A., i, 477.
- natural and artificial starch grains, A., i, 477.
- Roeder, Georg**. See **Carl D. Harries**.
- Röhmman, Franz**, digestion of carbohydrates by *Aplysia*, A., ii, 289.
- Roeser and Puaux**, composition of the gum of *Grevillea robusta*, A., i, 82.
- Rössing, Adelbert**, tinned fish, A., ii, 513.
- Rössing, R.**, detection of "saccharin" in beer, A., ii, 119.
- Rössler, Heinrich**, behaviour of rhodium in alloys with the noble metals, A., ii, 732.
- [estimation of small quantities of platinum in gold], A., ii, 767.
- Rogers, Allen**, tests for tin, A., ii, 445.
- Rogers, Allen**, and **F. H. Mitchell**, preparation of the blue oxide of molybdenum and of metallic molybdenum, A., ii, 597.
- Rogers, Austin F.**, ankerite from Missouri, A., ii, 550.
- Rogers, H. F.** See **Eugene T. Allen**.
- Roggatz, Heinrich**. See **Conrad Willgerodt**.
- Rogóyski, Casimir**, denitrification and decomposition of animal matters in soil, A., ii, 360.
- Rohde, Albert**, electrolytic reduction of *m*-nitrotoluene, A., i, 20.
- Rohland, Paul**, reactions in water and acetone, A., ii, 468.
- Rohm, Karl**. See **Josef Herzig**.
- Rohmer, Martin**. See **Jacob Meyer**.
- Rejahn, Wilhelm**. See **Hugo von Soden**.
- Roman, Th.**, and **G. Delluc**, detection of urobilin in urine, A., ii, 700.
- Romburgh, Pieter van**, nitration of dimethylaniline dissolved in concentrated sulphuric acid, A., i, 214.
- formation of indigo from Indigofera and from *Marsdenia tinctoria*, A., i, 230.
- crystallised constituent of the essential oil of *Kaempferia Galanga*, L., A., i, 677.
- Romijn, Gysbert**, estimation of nitrous acid, A., ii, 510.
- Ronthal**. See **Carl Adam Bischoff**.
- Rooseboom, Hendrik Willem Bakhuis**, nature of inactive carboxime, A., i, 240.
- melting point in systems of optical isomerides, A., ii, 64.
- conversion of mixed crystals into a compound, A., ii, 70.
- freezing points of mixed crystals of two compounds, A., ii, 132.
- transition points in mixed crystals, A., ii, 132.
- iron and steel from the standpoint of the phase rule, A., ii, 728.
- Rosauer, Otto**. See **J. Freundlich**.
- Roscoe, Sir Henry Enfield**, Bunsen Memorial Lecture, T., 513; P., 1900, 84.

- Rose, Thomas Kirke**, note on Volhard's method for the assay of silver bullion, T., 232; P., 1900, 5.
- Rosemann, Rudolf**, the proteid-sparing action of alcohol, A., ii, 92, 356.
- influence of alcohol on milk secretion, A., ii, 225.
- Rosenfeld, G.**, [elimination of] carbohydrates [in urine], A., ii, 358.
- Rosenheim, Arthur**, osmium, A., ii, 660.
- Rosenheim, Arthur**, and **Robert Cohn**, double thiocyanates, A., i, 381.
- Rosenheim, Arthur**, and **Hermann Itzig**, some complex salts of tartaric and malic acids, and their specific rotatory power, A., i, 135, 272.
- complex palladium salts, A., ii, 282.
- Rosenheim, Arthur**, and **Johannes Schilling**, thorium salts, A., ii, 351.
- Rosenheim, Arthur**, and **Siegfried Steinhäuser**, double thiosulphates and sulphites of the alkali metals, silver and copper, A., ii, 652.
- double salts of ammonium thiosulphate with silver and copper haloids, A., ii, 653.
- Rosenheim, Otto**, and **Philip Schidrowitz**, comparative analyses of, and digestion experiments with, white and whole-meal breads, A., ii, 289.
- some analyses of modern "dry" champagne, A., ii, 372.
- Rosenheim, Otto**. See also *Francis W. Tunnicliffe*.
- Rosenqvist, Emil**, sugar formation in severe cases of diabetes, A., ii, 155.
- Rosenstein, Wladimir**, relationship between the chemical constitution of alkylated alkaloids and their physiological action, A., ii, 294.
- Rosenstiehl, Auguste**, reproduction of yeast without fermentation in a limited supply of air, A., ii, 229.
- Roser, Wilhelm**, narcotine, A., i, 51.
- Rosin, Heinrich**, estimation of the reducing power of urine, blood, and other animal fluids, A., ii, 319.
- Rosset, G.**, drop methods for the determination of molecular weights, A., ii, 336.
- Roet, E.**, fate of 8-hydroxyquinoline; excretion of ethereal hydrogen sulphates; composition of quinosol, A., ii, 154.
- Roth**, secretion of pepsin in gastric disease, A., ii, 422.
- Roth, W. A.**, affinity constants of acids containing a ring of seven carbon atoms, A., ii, 590.
- Rothmund, Victor**, electromotive force and chemical equilibrium, A., ii, 183.
- Rothmund, Victor**, changes of solubility by addition of salts, A., ii, 467.
- Rotschy, A.** See *Amé Pictet*.
- Revaart, H. van de**. See *Karl Auwers*.
- Rowland, Sydney**. See *Allan Macfadyen*.
- Rudenko**. See *Nicolai N. Ljubavin*.
- Rudin, Ernst**. See *Hans Kreis*.
- Rudolph, P.** See *Wilhelm Autenrieth*.
- Rügheimer, Leopold**, py-benzylisoquinolines, A., i, 522.
- diazobenzene nitrate from nitroso-phenylhydrazine, A., i, 532.
- constitution of hippuroflavin, A., i, 609.
- Rügheimer, Leopold**, and **F. Fehlhaber**, homologues of hippuroflavin, A., i, 609.
- Rüttimann, E.** See *Friedrich Kehrman*.
- Ruff, Otto** [and in part *Meusser*], d-erythrose, A., i, 139.
- Ruff, Otto**, and *Gerhard Ollendorff*, separation and purification of sugars, A., i, 77.
- degradation of d-galactose and of lactose; d-lyxose and galactoarabinose, A., i, 476.
- Ruff, Otto**. See also *Emil Fischer*.
- Ruffin, A.**, changes in the constituents of butter fat under the influence of feeding, A., ii, 324.
- Ruhemann, Siegfried**, and *Frederick Boddow*, condensation of phenols with esters of the acetylene series. Part I. Action of phenols on ethyl phenylpropionate, T., 984; P., 1900, 123.
- condensation of phenols with esters of the acetylene series. Part II. Action of phenols on ethyl phenylpropionate and ethyl acetylenedicarboxylate, T., 1119; P., 1900, 165.
- Ruhemann, Siegfried**, and *Henry Ernest Stapleton*, formation of heterocyclic compounds, T., 239; P., 1900, 11.
- condensation of ethyl acetylenedicarboxylate with bases and β -ketonic esters, T., 804; P., 1900, 121.
- condensation of phenols with esters of the acetylene series. Part III. Synthesis of benzo- γ -pyrone, T., 1179; P., 1900, 168.
- Rumpp, Theodor**, and *O. Schumm*, metabolism in a vegetarian, A., ii, 222.
- chemical changes in the blood produced by feeding with ammonium sulphate, A., ii, 417.
- Rung, F.** See *A. Bins*.
- Runge, Carl**, spectrum of radium, A., ii, 641.
- Rupe, Hans**, cineolic acid, A., i, 371.

- Rupe, Hans, and Hans Labhardt**, as-phenylhydrazine derivatives, A., i, 250.
 — synthesis of phenylhydroxytriazoles, A., i, 258.
- Rupp, Erwin**, iodometric estimation of hydrogen peroxide, alkali percarbonates and persulphates, A., ii, 572.
 — volumetric valuation of syrup of ferrous iodide, A., ii, 580.
 — volumetric estimation of mercuric chloride, A., ii, 628.
- Ruschhaupt, Walter**, acetone glycosuria, A., ii, 675.
- Russell, Edward John**, notes on the estimation of gaseous compounds of sulphur, T., 352; P., 1900, 41.
 — influence of the nascent state on the combination of dry carbon monoxide and oxygen, T., 361; P., 1900, 42.
- Russell, Edward John, and Norman Smith**, the combination of sulphur dioxide and oxygen, T., 340; P., 1900, 41.
- Russell, H. L.** See *S. Moulton Babcock*.
- Russig, Friedrich**, orthocarboxylic acids and other derivatives of 1:2- and 1:4-dihydroxynaphthalene, A., i, 601.
- Ruszwurm**, estimation of chloral hydrate and morphine in organs, A., ii, 121.
- Rutherford, E.**, a radio-active substance emitted from thorium compounds, A., ii, 361.
 — radio-activity produced in substances by the action of thorium compounds, A., ii, 352.
- Rydberg, Johannes Robert**, hardness of elementary substances, A., ii, 392.
- Ryland, Garnett**, liquid mixtures of constant boiling point, A., ii, 64.
- Rzuchowski.** See *Carl Adam Bischoff*.
- S.
- Sabanéoff, Alexander P.** [with A. Dehewachoff, M. Efross, Z. Ginsburg, J. Lemke, M. Prosin, and A. Wlassoff], isomerism of salts of ammonium, hydroxylamine, and hydrazine, A., ii, 18.
- Sabatier, Paul, and Jean Baptiste Senderens**, action of copper on acetylene; formation of cuprene, a highly condensed hydrocarbon, A., i, 197.
 — hydrogenation of acetylene in presence of copper, A., i, 421.
 — hydrogenation of ethylene in presence of reduced metals, A., i, 469.
 — hydrogenation of acetylene in presence of reduced iron or cobalt, A., i, 470.
- Sabatier, Paul, and Jean Baptiste Senderens**, hydrogenation of acetylene and ethylene in the presence of finely divided platinum, A., i, 471.
 — action of reduced nickel on acetylene, A., i, 471.
 — action of finely divided platinum, cobalt, and iron on acetylene and ethylene, A., i, 534.
- Sabbatani, Luigi**, [physiological action of] acetonedicarboxylic acid and citric acid, A., ii, 32.
 — [separation of acetone from acetoacetic and acetonedicarboxylic acids], A., ii, 56.
 — [physiological action of] cyanotetramethylpyridone, A., ii, 94.
 — oxidation of citric acid and citrates with potassium permanganate or with iron, A., i, 536.
- Sacerdotti, Cesare**, fat in cartilage, A., ii, 291.
- Sacharoff, N.**, enzymes, A., i, 268.
- Sachs, Franz**, condensation of aromatic nitroso-compounds with methylene derivatives, A., i, 362.
- Sahlbom, Naima.** See *J. G. Andersson*.
- Saint Martin, L. G. de**, absorptive power of haemoglobin for oxygen and carbon monoxide, A., ii, 665.
- Salaskin, Sergei, and J. Zaleski**, results of the extirpation of the liver in dogs, A., ii, 607.
- Salfeld, A.** See *Bruno Tacke*.
- Saligny, Alfons O.**, Roumanian petroleum, A., ii, 282.
- Salkowski, Ernst [Leopold]**, fermentation of pentoses, A., i, 628.
 — estimation of oxalic acid and the occurrence of oxaluric acid in urine, A., ii, 635.
 — origin and excretion of oxalic acid, A., ii, 740.
- Salmoni, L.** See *Antonio Piccinini*.
- Salvadori, Roberto, and G. Pellini**, colorimetric method for the estimation of silica in mineral waters, A., ii, 367.
- Salvadori, Roberto.** See also *Raffaele Nasini*.
- Salzer, Theodor**, regularities in melting points, A., ii, 280.
 — water of crystallisation, II., A., ii, 270.
- Samelson, Minna.** See *Carl Friedheim*.
- Samoggia, M.**, hemp, A., ii, 750.
- Sand, Julius, and Karl A. Hofmann**, action of propylene and butylene on mercuric salts, A., i, 385.
 — action of allyl alcohol on mercuric salts, A., i, 386.
- Sand, Julius.** See also *Karl A. Hofmann*.

- Sandelin, S. S.**, furfuroylacetic acid and methyl furfuryl ketone, A., i, 305.
 — furfurylsuccinic acid [furfurylcarbiny succinic acid], A., i, 306.
 — furysuccinic acid [furfurylsuccinic acid], A., i, 306.
Sander, W., relation of physical properties of elements to their atomic weights, A., ii, 137.
Sanders, W. Murray. See *Henry Lord Wheeler*.
Sanford, George R. See *Leonard P. Kinnicut*.
Sani, Giovanni, germination of the olive, A., ii, 613.
Sapozhnikoff, A. V., condition of nitrous acid in aqueous solutions, A., ii, 722.
Sargent, C. L. See *Homer J. Wheeler*.
Sargent, George William, estimation of boric acid in tourmaline, A., ii, 47.
 — estimation of nickel in nickel steel, A., ii, 51.
 — repeated use of copper potassium chloride for the solution of steel or iron in estimating carbon, A., ii, 440.
 — rapid method for the estimation of carbon in iron or steel by combustion, A., ii, 574.
Sarghel, Jon, electrolysis of the bromides of the alkaline earth metals, A., ii, 400.
Sarles, E. H., colour of chlorine solutions, A., ii, 72.
Sarthou, J., schinoxydase, an oxydase present in *Schinus molle*, A., i, 575.
 — function of iron in schinoxydase, A., i, 575.
Satie. See *Paul Jeaneard*.
Saulmann, Fritz, thiazolines and oxazolines, A., i, 687.
Saunders, A. P., allotropic forms of selenium, A., ii, 650.
Saunders, A. P. See also *Wilhelm Meyerhoffer*.
Scarlata, Giuseppe, mechanical analysis of soils; separation of clay and sand, A., ii, 368.
Schäfer, A. See *Otto Wallach*.
Schaefer, George L., the chromic acid test for cocaine, A., ii, 58.
Schaer, Eduard, nature of Klunge's aloin reactions and the oxidising action of cupric salts in presence of cyanogen compounds, A., i, 512; ii, 583.
 — employment of chloral hydrate in the estimation of alkaloids, A., ii, 57.
 — hygienic significance of nitrites in drinking water, A., ii, 438.
 — action of chloroform and similar solvents on alkaloid salts, A., ii, 455.
Schall, [Joh. Friedrich] Carl, phenylhydrazone-carbo- and -dicarbo-diimine; the decomposition product of Wessel's dicarbo-base, A., i, 464.
 — vapour density of sulphur, A., ii, 271.
Schall, Max. See *Wilhelm Traube*.
Schaller, Robert, gas-washing apparatus; rapid and accurate process for the estimation of carbon dioxide, A., ii, 48.
Schaposchnikoff, W. G., new blue dyes of the thiazine series, A., i, 523.
Schaposchnikoff, W. G. See also *Richard Mühlau*.
Scharizer, Rudolf, constitution and genesis of iron sulphates, A., ii, 349.
Schattenfroh, Arthur, and *R. Grassberger*, butyric acid fermentation, A., ii, 230.
Schats, N. See *Ivan L. Kondakoff*.
Schaum, Karl, concentration-cells with unalterable electrodes, A., ii, 2.
Scheffer, J. C. Th., influence of alcohol on muscular work, A., ii, 418.
Scheibe, Anton, natural butter, showing the sesamé oil reaction, A., ii, 236.
Scheibe, Robert, löllingite from the Harz, A., ii, 661.
Schellhorn, B. See *Wilhelm Windisch*.
Schenck, Rudolf, [crystalline liquids], A., ii, 339.
 — determination of the transition temperature of monotropic dimorphous substances, A., ii, 465.
Scherbatsoheff, D., elimination of arsenic from the system from a toxicological standpoint, A., ii, 622.
Scherpe, R., chemical alteration of rye and wheat on becoming mouldy, A., ii, 429.
Scheye, Anton, [validity of Maxwell's equations], A., ii, 254.
Schidrowits, Philip. See *Otto Rosenheim*.
Schieber, W., influence of ammonia on magnesium salts, A., ii, 345.
Schiess, Emanuel. See *Fritz Fichter*.
Schiff, Hans. See *Alfred Wohl*.
Schiff, Hugo, amygdalinamidoxime, A., i, 49.
 — methyleneasparagine and allied compounds, A., i, 85.
Schiff, Hugo [with *Mario Betti*, and *Giulio Marzichi*], polyaspartic acids, A., i, 279.
Schiff, Robert, preparation and configuration of the six isomeric inactive benzylidenebisacetylacetones, A., i, 39.
Schiffer, Fr. See *S. Jellinek*.
Schild, L. See *Friedrich Kehrman*.
Schilling, Johannes. See *Arthur Rosenheim*.

- Schilling, Rudolf von.** See *Daniel Vorländer*.
- Schimansky, St.**, cause of the change of colour of Congo-red by the action of acids, A., i, 305.
- Schimmel and Co.**, ethereal oils, A., i, 184.
- estimation of geraniol in oil of citronella, A., ii, 175.
- Schindelmeiser, Iwan**, detection of nicotine, A., ii, 380.
- Schindelmeiser, Iwan.** See also *Iwan L. Kondakoff*.
- Schindler, P.** See *August Michaelis*.
- Schirmeisen, Karl**, representation of the periodic system of the elements, A., ii, 397.
- Schjerring, [Niels Christian] Henrik**, precipitation of proteids, A., ii, 779.
- Schlagdenhauffen, Charles Frédéric**, and *C. Pagel*, sulphuric acid containing selenium, A., ii, 342.
- Schleicher, F.** See *Karl Auwers*.
- Schlesinger, Alfred.** See *Carl Bülow*.
- Schlossing, [Jean Jacques] Théophile**, solubility of tricalcium phosphate in natural waters in presence of carbonic acid, A., ii, 541.
- phosphoric acid in presence of saturated solutions of calcium hydrogen carbonate, A., ii, 618.
- Schlossing, Th., jun.**, utilisation by plants of the potash dissolved in the water in soil, A., ii, 306.
- Schlösser, Peter.** See *Conrad Willgerodt*.
- Schlossberg, J.**, some racemic substances, A., i, 376.
- Schlossberg, S.**, 3-bromo-1-indone and its derivatives, A., i, 665.
- Schlotterbeck, Julius O., Adlumia cirrhosa**—a new protamine-bearing plant, A., ii, 746.
- Schlotterbeck, Julius O.** See also *Paul Murrill*.
- Schmalahofer, F. X.**, condensation of acetaldehyde with propaldehyde, A., i, 626.
- Schmidinger, Franz**, estimation of chloral alcoholate, A., ii, 327.
- Schmidt, C.**, technical gas analysis, A., ii, 508.
- Schmidt, Carl**, [celestite from Balthsiedenthal, Switzerland], A., ii, 217.
- Schmidt, Ernst [Albert]**, action of iodine on piperidine, tetrahydroquinoline, and tetrahydroisquinoline, A., i, 187.
- alkaloids present in the seeds of *Anagallis foetida*, A., i, 513.
- estimation of the alkaloids of the leaves of *Datura Stramonium*, *Hyoscyamus niger*, and *Atropa Belladonna*, A., ii, 379.
- Schmidt, Ernst**, and *H. Hartong van Ark*, action of bromoacetophenone on piperidine, A., i, 686.
- action of bromoacetophenone on pyridine, A., i, 687.
- Schmidt, Julius**, reduction of nitrobenzene with sodium, A., i, 20.
- action of sodium on *p*-nitrotoluene, A., i, 20.
- action of nitrogen trioxide on *a*-naphthaquinone, A., i, 299.
- electrolytic oxidation of ketoximes; new method of preparing aliphatic nitroso-compounds, A., i, 332.
- Schmidt, Otto.** See *Eugen Bamberger*.
- Schmidt, Paul.** See *Martin Krüger* and *Johannes Wislicenus*.
- Schmidt, R.**, examination of violet preparations for ionone, A., ii, 375.
- Schmidt, Th.** See *Stanislaus von Kostanecki*.
- Schmiedeberg, Oswald**, nucleic acid from salmon milt, A., i, 267.
- Schneider**, separation of lactic, butyric, and valeric acids, A., ii, 177.
- Schneider, E. C.** See *Lafayette B. Mendel*.
- Schneider, Robert**, bismuth suboxide and subsulphide, A., ii, 212.
- Schneidewind, W.**, conservation of manure, A., ii, 105.
- amount of mineral matter and of nitrogen in sugar-beet variously manured and in different soils, A., ii, 364.
- Schneidewind, W.** See also *W. Krüger* and *Max Heinrich Maereker*.
- Schoen, M.** See *Friedrich Kehrman*.
- Schöndorff, Bernhard**, urea in human milk, A., ii, 556.
- Schöndorff, Bernhard** [with *Heinrich Offergeld*], origin of glycogen from proteid, A., ii, 740.
- Schönrock, Otto**, variation of the specific rotation of sucrose with the temperature, A., i, 378.
- Schell, Roland**, constitution and syn-
thetical application of mercury fulminate. I. Direct aldoxidation of benzene, A., i, 144.
- Schell, Roland**, and *F. Kaeer*, relation of fulminic to isocyanic acid, and the formation of phenylurethane from phenol and mercuric fulminate, A., i, 218.
- Schell, Roland**, and *Wilhelm Mörr*, action of chlorine monoxide on benzene, A., i, 337.
- action of cyanogen bromide and aluminium chloride on benzenoid hydrocarbons and phenol ethers, A., i, 386.

- Schell, Roland**, and **Wilhelm Mörr**, action of cyanogen bromide on dimethyl- and diethyl-aniline, A., i, 435.
 ——— action of cyanogen bromide on phenol, A., i, 436.
Scholtz, Max, quantitative estimation of alkaloids by means of standardised solutions of iodine, A., ii, 638.
Scholtz, IV., biological detection of arsenic in skin, hair, perspiration, and urine, A., ii, 244.
Scholtze, K. See **Albert Ladenburg**.
Schoorl, N., isolation and separation of the chief organic acids, A., ii, 449.
 ——— detection of sodium in the presence of potassium, A., ii, 625.
Schreckenberger, Paul. See **Richard Stoermer**.
Schreiber, Constant, phosphates, A., ii, 506.
Schreiber, E., and **Zaudy**, deposits of uric acid artificially produced in birds, A., ii, 292.
Schreiber, Hermann. See **Robert Behrend**.
Schreinemakers, Frans Antoon Hubert, equilibrium in the system; water, phenol, aniline, A., ii, 135.
 ——— equilibria in the system; water, phenol, and *d*-tartaric or racemic acid, A., ii, 393.
 ——— equilibria in the system; water, phenol, and acetone, A., ii, 393.
Schreiner, Oswald, and **Edward Kremers**, nitroso-derivatives of caryophyllene and cadinene and their bearing on the characterisation and classification of the sesquiterpenes, A., i, 106.
Schriebeaux, E., nitragin, A., ii, 505.
Schröder, E. See **Wilhelm Muthmann**.
Schroeter, Georg, and **M. Peschkes**, new hydroxylamine derivatives of formic acid, A., i, 485.
Schryver, Samuel Barnett, and **Frederick H. Lees**, researches on morphine. Part I., T., 1024; P., 1900, 143.
Schtarbanow, P. See **P. N. Raikow**.
Schucht, Ludwig, reversion of soluble phosphoric acid in superphosphates, A., ii, 44.
Schümann, M., diazotisation and the affinity constants of nitrous acid, A., ii, 264.
Schüpphaus, Robert C., behaviour of zinc oxide at high temperatures, A., ii, 207.
Schütte, H., Stutzer and Hartleb's process for the estimation of combined carbon dioxide (calcium carbonate) in soils, A., ii, 48.
Schütz, Emil, and **Karl Hugo Huppert**, peptic digestion, A., ii, 553.
Schütz, J., separation and estimation of formic, acetic, propionic and butyric acids, A., ii, 250.
Schütz, Julius, quantitative relationships of pepsin activity, A., ii, 666.
Schukoff, Iwan, trehalose, A., i, 628.
Schulten, August [**Benjamin (Baron)**] *de*, production of iodated potassium and sodium carnallites, A., ii, 343.
 ——— production of cadmium vanadinites, A., ii, 346.
 ——— crystallised bismuth salts, A., ii, 353.
Schultze, Albert, benzoyl derivatives of amino-acids formed by the fission of proteids, A., i, 595.
Schulz, Friedrich N., oxidation of crystalline egg-albumin by hydrogen peroxide, A., i, 266.
 ——— does cellulose occur in the shield of Sepia? A., ii, 292.
Schulz, Friedrich N., and **Fritz Ditt-horn**, galactoseamine, a new amino-sugar as a decomposition product of the glucoprotein of the albuminous gland of the frog, A., i, 478.
Schulze, Bernard, effect of milk preservatives on milk fat, A., ii, 251.
 ——— maize-germ molasses as food for cows, A., ii, 502.
Schulze, Ernst, arginine, A., i, 515.
 ——— histidine and lysine in seedlings, A., ii, 101.
 ——— formation and decomposition of albumin in the plant, A., ii, 612.
 ——— proteid metabolism in plants, A., ii, 745.
Schulze, Ernst, and **Ernst Winterstein**, constitution of arginine, A., i, 110.
 ——— histidine and lysine in the decomposition products of conifer seeds, A., ii, 101.
Schumacher, and **W. L. Jung**, estimation of mercury in urine, A., ii, 247.
Schumann, Hans, products of the action of sulphur dioxide on ammonia, A., ii, 271.
Schumm, O. See **Theodor Rumpf**.
Schunck, C. A., yellow colouring matters accompanying chlorophyll and their spectroscopic relations, A., ii, 36.
Schunck, C. A. See also **Leon Marchlewski**.
Schur, Heinrich. See **Richard Burian**.
Schuyten, M. C., double chloride-copper and antipyrine, A., i, 57.
 ——— metallic benzopyrines, A., i, 57.
 ——— constitution of metallic salipyrrines, A., i, 57.
 ——— a new type of ammonio-copper chromate, A., ii, 279.
 ——— chemical processes in the stomach, A., ii, 509.

- Schwabe, G.** See *August Michaelis*.
Schwanke, Arthur, crystalline form of histidine dichloride, A., i, 608.
 — crystals from pigeons' blood, A., i, 711.
Schwarz, Ph. See *Theodor Zincke*.
Schwarz, Rudolf. See *Wilhelm Traube*.
Schweinfurth, G., and L. Lewin, Egyptian soda valleys, A., ii, 283.
Schweitzer, Rudolf, colouring matters contained in "sugar colours" and their detection, A., i, 277.
Scott, Alexander, preparation of pure hydrobromic acid, T., 648; P., 1900, 69.
 — a new sulphide of arsenic, T., 651; P., 1900, 69.
Schaldt, F. See *Arthur Hantzsch*.
Sebor, J. See *Emil Votoček*.
Seegen, Josef, substances present in the liver which are converted into sugar by acids, A., ii, 29.
Segaller, D. See *Georg Lunge*.
Seifart, A. See *Stanislaus von Kostanecki*.
Seissl, Josef, and Emanuel Gross, experiments with horse beans in soils of various origin under the same climatic conditions, A., ii, 430.
Seitz, E. See *Friedrich Bullnheimer*.
Sell, William James, and Frederick William Dootson, the chlorine derivatives of pyridine. Part IV. Constitution of the tetrachloropyridines, T., 1; P., 1899, 205.
 — chlorine derivatives of pyridine. Part V. Constitution of citrazinic acid; formation of 2:6-dichloropyridine and 2:6-diiodoisonicotinic acid, T., 233; P., 1900, 9; discussion, P., 11.
 — chlorine derivatives of pyridine. Part VI. Orientation of some chloroaminopyridines, T., 771; P., 1900, 111.
Semenoff. See *Seemenoff*.
Semmler, Friedrich Wilhelm, tanacetone and its derivatives, A., i, 240.
 — borneol and isoborneol, A., i, 351.
 — pseudo- and ortho-series of terpenes, terpene-alcohols, and terpene-ketones, A., i, 452.
 — carvotanacetone, tanacetone, and terpenone, $C_{10}H_{16}O$ (from tetrahydrocarvone), A., i, 676.
Semple, W. See *Arthur Hantzsch*.
Sempolowski, A., manual experiments with phosphorite and basic slag, A., ii, 43.
 — experiments with different lupins, A., ii, 103.
 — analysis of Siberian arable soil, A., ii, 433.
Senderens, Jean Baptiste. See *Paul Sabatier*.
Seno, K. See *K. Katsuyama*.
Serra, E., preparation of tetrachloromethane, A., i, 74.
Serra, E. See also *Giuseppe Oddo*.
Seton, A. M., and K. L. Stevenson, presence of potassium nitrite in brown powder residues when the powder is burnt in air under ordinary pressure, A., ii, 276.
Seubert, Karl. See *Hans Landolt*.
Seuffert, Otto. See *Adolf von Baeyer*.
Severin, Emile C., 3:4-dichloro-2-dimethylaminobenzoylbenzoic acid, A., i, 296.
 — dichlorophthalic acids; products of condensation, A., i, 445.
 — preparation of dialkylaminodichloroanthraquinones, A., i, 450.
 — products of condensation of dichlorophthalic anhydride with diethylaniline, A., i, 598.
Sevin. See *Arthur Köts*.
Sewerin, S. A., decomposition of nitrates by Bacteria, A., ii, 232.
Seyda, Anton, standardising acids, A., ii, 44.
 — estimation of the volatile acids in butter by Leffmann-Beam's glycerol-soda process, A., ii, 772.
Seyewetz, Alphonse, combination of basic with acidic colouring matters, A., i, 356.
 — composition of compounds of magenta with acidic colouring matters, A., i, 522.
 — combination of magenta with the sulpho-conjugated azo-colouring matters, A., i, 614.
 — compounds of magenta with acid colouring matters having a basic chromophore, A., i, 645.
Shaw, H. Batty, milky serous effusions, A., ii, 229.
Shedden, Frank, composition of berberine phosphate, A., i, 683.
Shedden, Frank. See also *Frederick B. Power*.
Sherman, H. C., and P. B. Hawk, elimination of nitrogen, sulphates, and phosphates after ingestion of proteid food, A., ii, 421.
Sherman, H. C., and Henry St. John Hyde, estimation of phosphoric acid as phosphomolybdic oxide, A., ii, 757.
Sherman, P. L., and C. H. Briggs, saw palmetto, A., ii, 102.
Shields, John, nature of palladium hydrogen, A., ii, 215.
Shimer, Porter W., a simplified reductor, A., ii, 50.

- Shukoff, Al. A.**, and **K. T. Nogin**, analysis of soap, A., ii, 326.
- Shuttleworth, A. E.**, method and apparatus for incinerating vegetable and animal substances, A., ii, 372.
- Shuttleworth, A. E.**, and **Bernhard Tollens**, method and apparatus for incinerating vegetable and animal substances, A., ii, 111.
- Sieber, Nadina**, Umikoff's reaction with human milk, A., ii, 696.
- Siebner, Eduard O.** See **Erich von Hornbostel**.
- Siegfried, Max**, extractives of muscle, A., i, 127.
- Siertsema, L. H.**, influence of pressure on the rotation of solutions of sucrose, A., ii, 329.
- Sieverts, Adolf**, electrolytic formation of hypochlorites, A., ii, 470.
- Silberrad, Oswald**, contributions to the chemistry of hydrotetrazines and triazoles, T., 1185; P., 1900, 169.
- Silberrad, Oswald**. See also **Arthur Hantzsch**.
- Sillevaldt, H. E. Th. van**, derride and pachyrhizide, Indian fish poisons, A., i, 109.
- Simon, L. J.**, isopyromucic acid, A., i, 198.
- new product of the destructive distillation of tartaric acid, A., i, 624.
- isopyrottritic acid: a new pyrogenic product from tartaric acid, A., i, 624.
- Simonis, Hugo**, and **G. Wensel**, tribromocoumarin and its derivatives, A., i, 231, 496.
- bromocoumarins and their derivatives, III., A., i, 648.
- Sisley, Paul**. See **Paul Caseneuve**.
- Siw**. See **Carl Adam Bischoff**.
- Sjogren, Hjalmar**, analyses of mineral from the Langesund Fjord, A., ii, 734.
- Sjollema, B.**, manurial experiments with potatoes, A., ii, 304.
- influence of chlorides and other compounds present in crude Stassfurt salts on the composition and yield of potatoes, A., ii, 306.
- development and injurious effect of mustard oil from rape-cake, A., ii, 613.
- Skey, William**. See **Archibald Liveridge**.
- Skinner, Sidney**, electrochemical equivalent of carbon, A., ii, 523.
- Skraup, Zdenko Hanns** [and in part **H. Copony** and **G. Medanich**], constitution of β -isocinchonine, A., i, 605.
- Skraup, Zdenko Hanns** and **Rud. Zwerger**, α - and β -isocinchonine, A., i, 606.
- Slama, Franz**, preparation of hydroxystyrogallol, A., i, 177.
- halogen derivatives of anthragallol, A., i, 181.
- Slobodskoi**. See **Carl Adam Bischoff**.
- Slosson, E. E.** See **Julius Stieglitz**.
- Smedley, Ida**, benzylanilinesulphonic acids, P., 1900, 160.
- Smetham, Alfred**, and **F. Robertson Dodd**, some properties of rosin with special reference to the analysis of the fatty matter in soap, A., ii, 377.
- Smiles, Samuel**, action of alkyl iodides on the mercuric iodide sulphides of the fatty series, T., 160; P., 1899, 240.
- a contribution to the stereochemistry of sulphur: an optically active sulphine base, T., 1174; P., 1900, 168.
- Smith, Alexander**, potassium cyanide as a condensing agent, A., i, 38.
- Smith, Arthur W.** See **Harry Clary Jones**.
- Smith, Edgar Francis**, tungsten, A., ii, 80.
- Smith, Edgar Francis, E. A. Barnett**, and **Clarence Hall**, tungsten alkyls, A., i, 89.
- Smith, Edgar Francis**, and **Claude Dugan**, esters of tungstic acid, A., i, 76.
- Smith, Edgar Francis**, and **Hermann Fleck**, action of sulphur monochloride on tungsten trioxide, A., ii, 81.
- Smith, Edgar Francis**, and **Willett Lepley Hardin**, atomic weight of tungsten, A., ii, 80.
- Smith, Edgar Francis**. See also **Charles H. Clarke**, and **Harry M. Fernberger**.
- Smith, Harry Metcalfe**. See **Karl Auwers**, **Richard Bodmer**, and **Norman Leonard**.
- Smith, James F.** See **Harold Govett Colman**.
- Smith, James Lorrain**, the volume, total oxygen capacity, and percentage oxygen capacity of the blood in chlorosis and pernicious anæmia, A., ii, 416.
- Smith, James Lorrain**. See also **John Scott Haldane**.
- Smith, Norman**. See **Edward John Russell**.
- Smith, Robert H.**, and **Bernhard Tollens**, compounds of fructose (lævulose) with the haloid salts of the alkaline earths; oxidation of fructose, A., i, 378.
- — polarisation and reducing power of sorbose, A., i, 378.

- Smith, S. W. J.**, nature of electro-capillary phenomena. I. Their relation to the potential differences between solutions, A., ii, 330.
- Smith, Thorn**, estimation of arsenic in Paris green, A., ii, 47.
- Smits, A.**, a manostat, A., ii, 388.
- determination of the decrease in the vapour tension of solutions by means of the determination of the increase in the boiling point, A., ii, 389.
- diminution of vapour pressure and elevation of boiling point of dilute solutions, A., ii, 708.
- Smoluchowski, Mar.**, and **R. von Smolan**, thermal conductivity in gases, A., ii, 68.
- Smythe, J. S.** See **Arthur Hantzsch**.
- Snape, Henry Lloyd**, racemic and optically active forms of amarine, T., 778; P., 1899, 228; 1900, 118.
- Soave, Marco**, effect of removing the flowers on the assimilation of nitrogen by leguminous plants, A., ii, 498.
- Soch, Charles A.** See **Henry Barker Hill**.
- Sodeau, William Horace**, decomposition of chlorates, with special reference to the evolution of chlorine and oxygen, T., 137; P., 1899, 157.
- decomposition of chlorates. II. Lead chlorate, T., 717; P., 1900, 88.
- Soden, Hugo von**, constituents of West Indian sandalwood oil, A., i, 401.
- constituents of East Indian sandalwood oil, A., i, 677.
- Soden, Hugo von**, and **Wilhelm Rejahn**, an aromatic alcohol in German oil of roses, A., i, 489.
- sesquiterpene of oil of ginger, A., i, 605.
- Söldner, Friedrich**. See **William Camerer, sen. and jun.**
- Sohn, Karl Bernhard**, the sesamé oil reaction, and sesamé butter, A., ii, 55.
- Seldaini, Arturo**, and **E. Berté**, analysis of ethereal oils, especially the Citrus oils, A., ii, 173.
- Solly, Richard H.** and **Henry Jackson**, sulpharsenites of lead from the Binnenthal, A., ii, 599.
- Solonina, A.** See **Wladimir Ipatieff**.
- Solonina, Wassily**, γ -amino- $\beta\beta$ -dimethylbutane, A., i, 82.
- separation of primary, secondary, and tertiary amines by Ginsberg's method, A., i, 147.
- Soltzen, Paul**, Bechi's test for cottonseed oil, A., ii, 116.
- testing margarine and butter for sesamé oil, A., ii, 325.
- Soltzen, Paul**, Welmans' reaction for the detection of vegetable oils, A., ii, 697.
- Sommer, F.**, *m*-xylylamine and *m*-methylphenylethylamine, A., i, 388.
- Sonneborn, H.**, electrolytic reduction of *p*-nitroaniline, A., i, 464.
- Sonneborn, H.** See also **Fritz Foerster**.
- Sosnowski, Jan**, chemistry of the cell, A., ii, 100.
- Source**. See **Magnier de la Source**.
- Southerden, Frank**. See **Frederick William Streetfield**.
- Spaeth, Eduard**, volatile acids in beer: detection of neutralising agents in beer, A., ii, 177.
- Sparre, Fin**, estimation of formic acid in presence of acetic acid, A., ii, 449.
- Spear, J.** See **Arthur Hantzsch**.
- Specht, Leopold**, and **Fritz Lorenz**, estimation of tannin, A., ii, 515.
- Spencer, Leonard James**. See **George Thurland Prior**.
- Speranski, N.**, hydrogenation of allyl alcohol, A., i, 3.
- Speyers, Clarence Livingston**, boiling point curves, A., ii, 464.
- van't Hoff's equation and the molecular weights of liquids, A., ii, 10.
- Spesia, Giorgio**, solubility of quartz in sodium silicate solutions, A., ii, 595.
- Spiegel and Peritz**, Rosin's method for the determination of the reducing power of urine, etc., A., ii, 457.
- Spiegel, Leopold**, dinitrophenylpyridine chloride, A., i, 51.
- significance of the detection of nitrites in drinking water, A., ii, 318.
- composition of urinary calculi, A., ii, 422.
- *p*-nitrophenol as an indicator, A., ii, 754.
- Spilker, Adolf**. See **Gustav Kraemer**.
- Spiro, Karl**, influence of nitrogenous substances on the heat coagulation of proteids, A., i, 615.
- Sprankling, Charles H. G.** See **William Arthur Bone**.
- Sprenger, G.** See **Theodor Curtius**.
- Spring, Walther**, flocculation of turbid media, A., ii, 713.
- Springer, Edm.**, preparation of phosphorus trisulphide, A., ii, 399.
- Springer, L.** See **Georg von Georgievics**.
- Spruyt, G. Bellaar**, physiological action of methylnitroamine in relation to its chemical composition, A., i, 142.
- Ssemenoff, W.**, δ -bromoglutaric acid, A., i, 10.
- Ssyrotsohkin**. See **Carl Adam Bischoff**.
- Stadt, E. van de**, solubility in water of anhydrides of organic acids, A., i, 200.

- Staněk, Vl.**, automatic apparatus for the estimation of pentosans, A., ii, 373.
- Stanford, Edward Charles Cortis**, obituary notice of, T., 597.
- Stapleton, Henry Ernest**. See **Siegfried Ruhemann**.
- Stassano, Henri**, combination of nucleins with metallic compounds, alkaloids, and toxins, A., ii, 559.
- functions of the nucleus in relation to hæmoglobin formation and cellular protection, A., ii, 666.
- Staudenmaier, Ludwig**, graphite, A., ii, 15.
- Stavenhagen, Alfred**, preparation of tungsten with the aid of liquid air, A., ii, 80.
- preparation of molybdenum and uranium with the aid of liquid air, A., ii, 80.
- Stebbins, James H.**, the Reichert number for butter, A., ii, 55.
- Stechale, Fritz**. See **Julius von Braun**.
- Steele, Bertram D.** See **John Norman Collie**.
- Stefani, Pio de**, attempts to obtain active isomerides of hexahydro- and isohexahydro-mellitic acids, A., i, 349.
- Stefanini, A.** See **Angelo Batelli**.
- Steffens, Carl**, isomeric compounds, $C_6H_8O_4N_4$, from acetylmethylnitrolic acid, A., i, 74.
- Steglich**, manurial experiments with fruit trees, A., ii, 570.
- Steiger, George**. See **Frank Wigglesworth Clarke**.
- Steinhäuser, Siegfried**. See **Arthur Rosenheim**.
- Steinmann, Émile**, thermo-electrical properties of alloys, A., ii, 523.
- thermo-electricity of certain alloys, A., ii, 524.
- Stejkal, C. von**, and **Franz Erben**, [metabolism in leucæmia], A., ii, 423.
- Stenz, A.** See **Reinhold von Walther**.
- Stephan, Karl**. See **Heinrich Walbaum**.
- Stephens, J. W. W.**, hæmolytic action of snake toxins and toxic sera, A., ii, 228.
- Stern, Max**. See **Julius Tafel**.
- Stendel, H.**, and **Albrecht Kossel**, thymine, A., i, 467.
- Stevens, Henry Potter**. See **Frederick Daniel Chattaway**.
- Stevenson, K. L.** See **A. M. Seton**.
- Stiasny, Edmund**. See **Alfred Werner**.
- Stiegelmann, Armand**. See **Eugen Bamberger**.
- Stieglitz, Julius**, lecture experiments illustrating equilibrium and dissociation, A., ii, 469.
- Stieglitz, Julius**, and **Ralph H. McKee**, oxygen ethers of carbamides: methylisocarbamide, A., i, 340, 431.
- Stieglitz, Julius**, and **E. E. Slosson**, note on nitrogen halogen compounds, P., 1900, 1.
- Stielmann**. See **Carl Adam Bischoff**.
- Stobbe, Hans**, transformation of coloured unsaturated dicarboxylic acids into colourless stereoisomerides, A., i, 659.
- Stobbe, Hans** [and **Richard Fischer**], condensation of cyclic ketones with ethyl succinate, A., i, 179.
- Stock, Alfred**, constitution of auramine, A., i, 258.
- new method of estimating aluminium, A., ii, 247, 315.
- volumetric estimation of boric acid, A., ii, 312.
- Stock, Alfred**. See also **Henri Moissan**.
- Stocký, Alb.**, vanillin in wine vinegar, A., ii, 454.
- Stocký, Alb.** See also **Jos. Hanuš**.
- Stoeckl, K.**, and **Ludwig Vanino**, nature of colloidal metallic solutions, A., ii, 11, 713.
- Stoermer, Richard** [and in part **Hans Bauer**, **Johannes Boes**, **Curt von Finckh**, **Wilhelm Gräfenhan**, **Karl Paul Gräler**, **Alfred Gross**, **Maximilian Helbig**, **Ulrich Hermes**, **Fritz Kissel**, **Otto Richter**, **Paul Schreckenberger**, and **Alfred Teudeloff**], synthesis and degradation in the coumarone series, A., i, 650.
- Stoffel, F.** See **Theodor Zincke**.
- Stoffel, M.** See **Friedrich Kehrman**.
- Stokes, Henry N.** See **William Francis Hillebrand**, and **George Perkins Merrill**.
- Stoklass, Julius**, distribution and biological importance of furfuroids in soil, A., ii, 40.
- do the Bacteria of alinit assimilate atmospheric nitrogen? A., ii, 96.
- which forms of carbohydrates do denitrification Bacteria require for their vital processes? A., ii, 98.
- physiological importance of furfuroids in sugar-beet, A., ii, 100.
- influence of potash on the development of sugar-beet, A., ii, 163.
- injurious effect of sodium nitrate on the growth of sugar-beet, A., ii, 305.
- importance of Bacteria for the development of plants, A., ii, 360.
- present position of the nitrugin question, A., ii, 610.
- Stoklass, Julius**, **F. Ducháček**, and **J. Pitra**, influence of Bacteria on the decomposition of bones, A., ii, 684.

- Stolle, F.**, caramel substances, A., i, 209.
- is the diminution of the rate of inversion, caused by the presence of normal salts of inverting acids, due to the formation of esters? A., i, 277.
- solubility of salts of calcium, iron, and copper in sucrose solutions, A., i, 333.
- caramelsubstances. II. Estimation of caramel in aqueous solutions by means of the spectroscope, A., ii, 249.
- Finnish moss-berry (*Vaccinium oxycoccus*), A., ii, 614.
- Stollé, Robert**, hydrogenisation of ethyl succinylsuccinate, A., i, 234.
- Stollé, Robert**, and **A. Benrath**, metallic derivatives of *s*-dibenzoylhydrazine and the transformation of dibenzoylhydrazine into azodibenzoyl, A., i, 581.
- Stolz, Friedrich**, so-called isopyrazole derivatives, A., i, 252.
- Stone, Clinton, Kinsely**, and **Cavanagh**, sugar-beet in 1898, A., ii, 501.
- Storch, Karl**, the proteids of cows' milk, A., i, 266.
- Stortenbeker, Willem**, solubility of hydrated mixed crystals. III., A., ii, 530.
- Strasser and Gahl**, gaseous polarisation in the lead accumulator, A., ii, 642.
- Strasser, H.** See **Victor Mera**.
- Straub, Walther**, influence of removal of water on metabolism and circulation, A., ii, 91.
- Strauss, O.** See **Daniel Vorländer**.
- Streetfield, Frederick William**, and **Frank Southerden**, laboratory apparatus, A., ii, 718.
- Streeker, Günther**, action of oxygen on the excised mammalian heart, A., ii, 491.
- Streints, Franz**, electrical conductivity of compressed powders, A., ii, 641.
- Strigel, A.** See **Oscar Kellner**.
- Ström, Knut T.**, chemical composition of Norwegian tar from conifers, A., i, 28.
- Norwegian tar, A., i, 577.
- Strömholm, Daniel**, diethylenedisulphidethine, A., i, 12.
- sulphine and thine derivatives, A., i, 325.
- Strohbach, Erich**. See **Richard Möhlau**.
- Strohmer, Friedrich**, sugar as food, A., ii, 490.
- blood molasses, A., ii, 681.
- Stroppa, Cesare**. See **Dioscoride Vitali**.
- Struve, Heinrich**, the Florence reaction, A., ii, 328.
- Struve, Heinrich**, some properties of glycerol, A., ii, 446.
- Strzysowski, Casimir**, microchemistry of crystalline hæmatin compounds; detection of blood, A., ii, 123.
- Halphen's reaction and its application to the estimation of cotton-seed oil, A., ii, 325.
- Stützel, L.** See **Wilhelm Muthmann**.
- Stutzer, Albert**, and **R. Hartleb**, microorganisms observed in the formation of nitrates, A., ii, 97.
- Bacteria which destroy nitrates, A., ii, 359.
- Stutzer, Albert**, and **Hjalmar Jensen**, denitrification, A., ii, 494.
- Sudendorf, Th.** See **August Michaelis**.
- Süss, P.**, albumin in the cell of the queen bee, A., ii, 93.
- detection of sodium carbonate in milk, A., ii, 759.
- detection of salicylic acid in milk, A., ii, 770.
- Suiffet, Th.**, thyroid gland of sheep, A., ii, 671.
- Sule, Ottokar**, conductivity of some sodium derivatives of nitroparaffins, A., ii, 332.
- hydrolysis of polysaccharides and decomposition of esters; catalytic action of some metals, A., ii, 395.
- so-called electrolytic silver peroxide [silver peroxyhydrate], A., ii, 595.
- Suleiman Bey**, pentoses and methylpentoses, A., i, 377.
- [estimation of pentoses in urine], A., ii, 446.
- Sumuleanu, C.** See **Robert Pschorr**.
- Sunderph, Th.**, change of resistance of lead dioxide, A., ii, 5.
- Surie, J. J.**, milky juice of *Hura crepitans*, A., ii, 680.
- Suzuki, U.**, can strontium and barium replace calcium in Phænogams? A., ii, 561.
- arginine, A., ii, 562.
- formation of arginine in coniferous plants, A., ii, 562.
- Swarts, Frédéric**, fluorine derivatives of toluene, A., i, 637.
- Swoboda, J.**, volumetric estimation of free fatty acids, A., ii, 514.
- Sworn, Sidney Augustus**, obituary notice of, T., 598.
- Szyniewski, Wiktor**, constitution of starch, A., i, 78.
- Szyrochkin**. See **Seyrochkin**.
- Szanecki, J.** See **Richard E. Meyer**.
- Szarvasy, Emerique Charles**, electrolytic preparation of induline dyes, T., 207: P., 1899, 194.

Szarvasy, Emerique Charles, electrolysis of the nitrogen hydrides and of hydroxylamine, T., 603; P., 1900, 3.

Szöll, Ladislaus von. See **Tamas Kosutany**.

T.

Tacke, Bruno, field experiments on peat land, 1892-1897, A., ii, 42.

— alinit, A., ii, 434.

Tacke, Bruno, Heinrich Immendorff, and H. Minssen, composition of drainage from unmanured and manured peat soil, with special reference to nitrogen compounds, A., ii, 683.

Tacke, Bruno, Heinrich Immendorff, A. Salfeld, and Fr. Wolff, action of burnt lime and marl on sandy soil, A., ii, 616.

Tacke, Bruno, and Bernhard Tollens, composition of various kinds of peat, A., ii, 682.

Tacke, Bruno. See also **Heinrich Immendorff, and H. Minssen**.

Täuber, Ernst, detection of nitrogen in organic compounds containing sulphur, A., ii, 107.

Täuber, Ernst, and Franz Walder, formation of a nitrosoamine by the action of nitrous acid on a primary aromatic amine, A., i, 566.

Tafel, Julius, deoxytheobromine, A., i, 121.

— electrolytic reduction of difficultly reducible substances in sulphuric acid solution, A., ii, 588.

Tafel, Julius, and Max Stern, reduction of succinimides to pyrrolidones, A., i, 557.

Tafel, Julius. See also **Thomas B. Baillie, and Gottfried Fenner**.

Takano, S. See **Charles Frederic Mabery**.

Talanseff, Zinovy, β -methyltert-butyl-hydracrylic acid, A., i, 328.

Tambor, Josef [with **Ernst and Liciński**], indogenides of the pyrazole series, A., i, 364.

Tambor, Josef. See also **J. Czajkowski, and Stanislaus von Kostanecki**.

Tammann, Gustav, limits of the solid state, V., A., ii, 714.

Tanatar, Simeon M., peroxides, A., ii, 211.

Tanatar, Simeon M., and Boris Klimenko, formation of salts in alcoholic solutions, A., ii, 713.

Tanret, Charles, and Georges Tanret, rhamnose, A., i, 78.

— rhamninase and xantho-rhamnin, A., i, 185.

Tarassenko, W., [mineral analyses], A., ii, 26.

— composition of plagioclase, A., ii, 354.

Tasselli, Emilio, cork oak, A., ii, 750.

Tate, George, estimation of silicon in ferrochromium and of silica in chrome ore, A., ii, 313.

Tauss, Siegfried. See **Paul Cohn**.

Taverne, H. J., methyl ester and amide of *d*-valeric acid (methyl-2-butanolic acid), and the solubility of its silver salt, A., i, 472.

Taylor, J. B., heat of formation of alloys, A., ii, 710.

Taylor, A. Ernest, vapour pressure relations in mixtures of two liquids, I. and II., A., ii, 529.

Taylor, Alonzo Englebert, modified Soxhlet apparatus for the extraction of fats from liquids, A., ii, 115.
— pathological fats, A., ii, 606.

Taylor, Robert Llewellyn, action of iodine on alkalis, T., 725; P., 1900, 70.

Taylor, W. W., crystalline hydrates of sodium thiosulphate, A., ii, 206.

Tehernia, Joseph, preparation of ethyl-dichloroamine, A., i, 143.

Teclu, Nicolae, properties of flames, A., ii, 71.

— new ozone apparatus, A., ii, 72.

— estimation of ozone, A., ii, 437.

Termier, Pierre, leverrierite, A., ii, 86.

— epidote and zoisite, A., ii, 735.

Ternájský, Ludwig, preparation of 4-pyridinecarboxylic acid and some of its derivatives, A., i, 559.

Testoni, Giuseppe. See **Carlo Bignami and Giuseppe Plancher**.

Teudeloff, Alfred. See **Richard Stoermer**.

Tewes, A. See **Otto Wallach**.

Thaeter, Karl, estimation of santonin in the flower buds of *Artemisia maritima*, A., ii, 122, 775.

Theel, Walter. See **Otto Nikolaus Witt**.

Thiel, A., heat of neutralisation and electrolytic dissociation, A., ii, 280.

— reversible electrodes of the second order with mixed depolarisers, A., ii, 521.

Thiel, A. See also **Friedrich Wilhelm Küster**.

Thiele, F. C., Texas petroleum, A., ii, 147.

Thiele, Hermann, [luminosity of mixtures of thoria and ceria], A., ii, 208.

Thiele, Hermann, and R. Richter, standardising normal acids, A., ii, 620.

Thiele, Johannes, solid butadiene dibromide, A., i, 2.

- Thiele, Johannes**, ketone reactions of cyclopentadiene A., i, 298.
 — condensation products of indene and fluorene, A., i, 347.
 — the steric aspect of partial valencies, A., ii, 534.
- Thiele, Johannes**, and **Heinrich Eichwede**, constitution of tribromophenol bromide ("Tribromphenolbrom"), A., i, 288.
 — action of ethyl nitrite on trisubstituted phenols, A., i, 501.
- Thiele, Johannes**, and **Jakob Meisenheimer**, addition of hydrogen cyanide to quinone, A., i, 299.
- Thiele, Johannes**, and **Robert Howson Pickard**, transformation of hydroxamic acids, A., i, 29.
- Thiele, Johannes**, and **Ernst Winter**, oxidations in presence of acetic anhydride and sulphuric acid, A., i, 500.
 — action of acetic anhydride and sulphuric acid on quinones, A., i, 504.
- Thielsen-Dyer, Sir William T.**, influence of the temperature of liquid hydrogen on the germinative power of seeds, A., ii, 300.
- Thomas, George E.**, apparatus for the analysis of illuminating and fuel gases, A., ii, 169.
- Thomas, P.** See **Friedrich Kehrman**.
- Thomas, Victor**, action of mercury on methylene iodide, A., i, 213.
 — action of nitric oxide on chromyl dichloride, A., ii, 144.
 — estimation of thallium, A., ii, 442.
- Thomaschewski, P.** See **Otto Lohse**.
- Thomas-Mamert, René**, and **St. Weil**, action of hydrocyanic acid on ethyl cetipate, A., i, 427.
 — condensation of ethyl cetipate with *o*-diamines. I. Condensation with ethylenediamine and the naphthylene-*o*-diamines, A., i, 459.
- Thompson, William Henry**, influence of peptone and albumoses on urinary secretion, A., ii, 226.
 — physiological action of protamines and their decomposition products, A., ii, 227.
- Thoma, Hermann**, telfairia oil, A., i, 473.
 — constituents of cascarilla oil, and undecenoic acid, A., i, 622.
 — products in tobacco smoke, A., ii, 428.
 — [estimation of nicotine in cigars], A., ii, 455.
- Thomson, A.**, effect of ferments on the germination of old seed, A., ii, 496.
- Thomson, R. S.**, and **Alexander R. Ferguson**, sandy matter from the human intestine, A., ii, 228.
- Thorp, William**, obituary notice of, T., 599.
- Thorpe, Jocelyn Field**, constitution of ethyl sodiocyanacetate and of ethyl sodiomethylcyanacetate, T., 923; P., 1900, 113.
- Thorpe, Jocelyn Field**, and **William J. Young**, *cis*- and *trans*- α,β -tetramethylglutaric acids, T., 936; P., 1900, 114.
- Thorpe, Jocelyn Field**. See also **Fred H. Howles**, and **William Henry Perkin, jun.**
- Thorpe, Thomas Edward**, Victor Meyer Memorial Lecture, T., 169; P., 1900, 33.
 — presidential address, T., 555; P., 1900, 77.
 — progress of chemistry in Great Britain and Ireland during the 19th century, T., 562.
 — effect of feeding cotton and sesame cake on butter, A., ii, 237.
- Thudichum, John Lewis William**, reactions of phrenosin, the cerebrogalactoside from the human brain, A., i, 319.
 — some scientific and ethical questions of biological chemistry, A., ii, 609.
- Tiemann, [Johann Karl Wilhelm] Ferdinand**, methyl-2-heptene-4-one-6 and the synthesis of an aliphatic isogeranic acid, A., i, 275.
- Tiemann, Ferdinand**, [with **Max Kerschbaum**], stereoisomeric forms of citral, A., i, 331.
 — pinolic acid, A., i, 625.
- Tiemann, Ferdinand**. See also **Friedrich Mahla**.
- Tiemann, [Johann Karl Wilhelm] Ferdinand**, obituary notice of, T., 600.
- Tilden, William Augustus**, specific heats of metals and the relation of specific heat to atomic weight, A., ii, 524.
- Timoffeffsky, Dmitri J.**, action of lymphagogues on the proteids of blood and lymph, A., ii, 95.
- Timpe, H.**, milk analysis; new process for the simultaneous estimation of residue, fat, and ash, A., ii, 179.
 — constancy in the composition of cows' milk, and detection of its adulterations, A., ii, 251.
- Tingle, Alfred**, reactions of aniline and of hydroxylamine with hydroxy- and unsaturated compounds, A., i, 544.
 — new synthesis of secondary amines, A., i, 641.
 — influence of substituents on the electrical conductivity of benzoic acid, A., ii, 6.

- Tingle, John Bishop**, and **Alfred Tingle**, action of ethyl oxalate on camphor, V., A., i, 302.
- Tistschenko, Welschiaslaw E.**, [with **A. Gabounia**, **M. G. Kisseleff**, **N. Marasoueff**, and **N. N. Pushin**], action of amalgamated aluminium on alcohols; aluminium alkyl oxides, A., i, 269.
- Tixier, A.**, biological and chemical purification of water, A., ii, 71.
- Tocher, James F.**, volumetric estimation of red lead, A., ii, 442.
- Tollens, Bernhard**, methyleneglucose from glucose, formaldehyde, and hydrochloric acid; a new glucoside, A., i, 15.
- Tollens, Bernhard**. See also **G. H. A. Clowes**, **A. E. Shuttleworth**, **Robert H. Smith**, **Bruno Tacke**, **George M. Tucker**, and **John A. Widdsoe**.
- Tollesko, Stanislaw**, antimony trichloride in cryoscopy, A., ii, 190.
- Tollesko, Stanislaw**. See also **Ludwik Bruner**.
- Tommasi, Donato**, action of magnesium on saline solutions, A., ii, 16.
- metallic crystallisation by electric currents, A., ii, 339.
- Tommasina, Thomas**, metallic crystallisation by electrical transport of certain metals in distilled water, A., ii, 185.
- photochemical effects produced by the Hertzian radiating wire, A., ii, 519.
- Tourehot, A. L.**, acidity of milk, A., ii, 582.
- Touren, Charles**, solubility of mixtures of salts having one common ion, A., ii, 396, 530, 646.
- Tower, Olin Freeman**, [tartrates of nickel and cobalt], A., i, 587.
- potential differences with manganese dioxide electrodes, A., ii, 331.
- precipitation of the sulphides of nickel and cobalt in an alkaline tartrate solution, A., ii, 690.
- Trabert, H.** See **Wilhelm Marckwald**.
- Traphagen, Frank W.**, and **W. M. Cobleigh**, alkali soil in Montana, A., ii, 40.
- Trasciatti, D.** See **Luigi Balbiano**.
- Traube, Wilhelm**, a new synthesis of guanine and of xanthine, A., i, 416.
- Traube, Wilhelm**, and **A. Eyme**, additive products of the carbodiimides, A., i, 118.
- Traube, Wilhelm**, and **H. W. F. Lorens**, carbamide and thiocarbamide derivatives of diacetoneamine, A., i, 115.
- Traube, Wilhelm**, and **Max Schall**, carbamide and guanidine derivatives of diacetoneamine, A., i, 118.
- Traube, Wilhelm**, and **Rudolf Schwarz**, action of amidines on mesityl oxide and phorone, A., i, 116.
- Traube, Wilhelm**, and **Ernst von Wedelstädt**, phenylcyanamide, A., i, 389.
- Traun, F. A.** See **Karl Auwers**.
- Treff, W.** See **Paul Duden**.
- Trentler, G.** See **Franz Kunekell**.
- Trillat, Auguste**, action of nitrous acid on the leuco-base, $C_{18}H_{24}N_2$, A., i, 192.
- derivatives of the leuco-base $C_{18}H_{24}N_2$, A., i, 252.
- Trillat, Auguste**. See also **L. Alphonse Adrian**.
- Troeger, Julius**, action of ethyl acetoacetate and substituted acetoacetates on *p*-aminobenzoic acid in presence and absence of pyridine, A., i, 226.
- Troeger, Julius**, and **Erich Ewers**, α -dichlorothiopropionamide, A., i, 210.
- alkylthiosulphonated ethyl acetoacetate, A., i, 494.
- Troeger, Julius**, and **Otto Linde**, alkylthiosulphonates of organic bases, A., i, 515.
- [estimation of berberine], A., ii, 584.
- Troeger, Julius**, and **W. Meins**, estimation of sugar in diabetic urine, A., ii, 635.
- Trowbridge, John**, spectra of hydrogen and of aqueous vapour, A., ii, 701.
- Trowbridge, Perry F.**, behaviour of iodoform and chloroform with strychnine, A., i, 187.
- action of methylene iodide on strychnine, A., i, 187.
- derivatives of strychnine, A., i, 517.
- Trubeck, M.**, technical analysis of liquorice pastes, A., ii, 378.
- Truchon, R.**, detection of "saccharin" in articles of food, A., ii, 377.
- Truchot, P.**, estimation of sulphur in ores, mattes, etc., A., ii, 309.
- True, Rodney H.**, toxic action of a series of acids and of their sodium salts on *Lupinus albus*, A., ii, 303.
- Tscherdintseff, Wladimir**. See **Wladimir B. Markownikoff**.
- Tschermak, Erich**, distribution of lithium in plants, A., ii, 235.
- Tschermak, Gustav**, theory of tourmaline mixtures, A., ii, 217.
- Tschernik, G. P.**, gadolinite from Batum, A., ii, 551.
- Tscherweniwanow, N.** See **P. N. Raikow**.
- Tschireh, [Wilhelm Oswald] Alexander**, rhubarb and its active constituents, A., i, 185.

- Tschirch, Alexander**, and **Ed. Brüning**, the balsam of *Abies canadensis* (Canada balsam), A., i, 678.
- Tschirch, Alexander**, and **E. Hiepe**, senna, A., i, 681.
- Tschirch, Alexander**, and **R. Polacco**, the fruits of *Rhamnus cathartica*, A., i, 681.
- Tschirch, Alexander**, and **G. Weigel**, the balsam of *Abies pectinata* (Strasbourg turpentine), A., i, 679.
- the balsam of *Larix decidua* (larch turpentine), A., i, 680.
- Tschirner, Fred.** See **Eugen Bamberger**.
- Tschugaeff, L.**, new method of preparing unsaturated hydrocarbons, A., i, 129.
- conversion of carvone into limonene, A., i, 352.
- Tsuneto, K.**, phosphatic deposits in Japan, A., ii, 43.
- Tsvett, M.**, constitution of the colouring matter of leaves; chloroglobin, A., i, 50.
- reversible liquefaction of proteids, A., i, 67.
- Tucker, George M.**, apparatus for the estimation of plant-ash for analysis, A., ii, 52.
- Tucker, George M.**, and **Bernhard Tollens**, food-stuffs of the leaves of the plane tree and their migration during the growth and decay of the leaves, A., ii, 35.
- Türin, Vl. von**, extent to which the interaction of ionic charges diminishes the osmotic pressure, A., ii, 712.
- Tunnicliffe, Francis W.**, and **Otto Rosenheim**, salts of uric acid, A., i, 636.
- Tutton, Alfred Edwin**, comparative crystallographic study of the double selenates of the series $R_2M(SeO_4)_2 \cdot 6H_2O$. I. Salts in which M is zinc, A., ii, 593.
- Twitcheil, Ernst**, benzenestearosulphonic acid [sulphophenylstearic acid] and other sulphonic acids containing the stearyl group, A., i, 296.
- Tyler, Charles T.**, and **Alfred Wertheimer**, oil of turpentine, A., i, 676.
- U.**
- Udall, William.** See **Fred H. Howles**.
- Uellenberg, Emil.** See **Fritz Fichter**.
- Uhlenhuth, Rudolf**, preparation of free hydroxylamine, A., ii, 475.
- crystalline form of the nickel sulphate compound of hydroxylamine, A., ii, 482.
- platinum compounds of hydroxylamine, A., ii, 485, 659.
- Uhlfelder, Emil.** See **Ludwig Vamino**.
- Ulbricht, Richard**, pot experiments on the action of lime and magnesia in burnt lime and marls, A., ii, 240.
- Ullmann, Fritz**, and **Irma Goldberg**, purification of acetylene, A., i, 1.
- [estimation of chromic acid in acetylene purifiers], A., ii, 51.
- Ullmann, Fritz**, and **E. Naef**, syntheses in the acridine series. I. 2'-Methyl-1:2-naphthacridine, A., i, 360.
- syntheses in the acridine series. II. 3'-Amino-2'-methyl-1:2-naphthacridine, A., i, 361.
- aminonaphthacridinium compounds, A., i, 689.
- Ullmann, Fritz**, and **P. Wenner**, dimethyl sulphate as an alkylating agent, A., i, 619.
- Ullmann, Martin**, and **A. Grimm**, behaviour of water-soluble phosphoric acid in soils, A., ii, 431.
- Ulpiani, C.**, and **S. Condelli**, asymmetry and vitalism, A., ii, 463.
- resolution of a racemic compound by means of moulds, A., ii, 493.
- Ulrich, R.**, importance of poultry manure, A., ii, 308.
- Ulech, Karl**, electrolysis of solutions of sucrose, A., i, 15.
- Umbgrove, Hern.** See **Otto Wallach**.
- Umoff, Nicolai A.**, method for the exhibition of the properties of polarised light, A., ii, 181.
- Unruh, M. von.** See **Hugo Erdmann**.
- Urbain, G.**, separation of the rare earths, A., ii, 346.
- Ussow.** See **Nathan Zuntz**.
- Uts, F.**, detection of nitric acid in water and in milk, A., ii, 438.
- sesamé oil, A., ii, 699.
- volumetric estimation of corrosive sublimate in dressings, A., ii, 762.
- V.**
- Vaillant, Victor**, action of hydroxylamine and phenylhydrazine on dithio-benzoylacetone, A., i, 239.
- Valencien, Ch.** See **Friedrich Kehrman**.
- Valenta, Eduard.** See **Josef Maria Eder**.
- Valentine, William.** See **Henry Lord Wheeler**.
- Valeur, Amand**, volumetric estimation of quinones derived from benzene, A., ii, 57.
- estimation of halogens in organic compounds, A., ii, 172.
- Vámosy, Zoltán von**, may phenolphthalein be safely added to marc wines? A., ii, 676.

- Vandenbergh, Ad.**, dissociation of dissolved substances, I., A., ii, 335.
- Vanderveide, Alb. J. J.**, phenoxyacetic acid; bromination of phenoxybenzoic acid, A., i, 30.
- substituted dibasic acids; conversion of an acid chloride into an anhydride by the action of haloid acids, A., i, 272.
- plasmolysis; determination of the toxicity of alcohols, A., ii, 302.
- Vanino, Ludwig**, a general property of phosphorous acid, A., ii, 138.
- Vanino, Ludwig**, and **Otto Hauser**, separation of chlorine and iodine, A., ii, 165.
- action of hydrogen sulphide on lead peroxide, A., ii, 279.
- reduction of nitrates by lactic acid, A., ii, 722.
- Vanino, Ludwig**, and **Emil Uhlfelder**, organic peroxides, IV., A., i, 371.
- Vanino, Ludwig**. See also **Otto Hauser** and **K. Stoeckl**.
- Vannini, F.** See **Gaetano Magnanini**.
- Vanzetti, L.**, attempts to obtain optical antipodes of quadrivalent sulphur derivatives, A., i, 327.
- Vater, Heinrich**, formation of marine anhydrite, A., ii, 541.
- Vaubel, Wilhelm**, quinquivalent nitrogen, A., i, 485.
- phenyldiimine, A., i, 522.
- removal or substitution of sulphonic groups in naphthalene derivatives by nascent chlorine, A., i, 544.
- isomeric forms of diazoaminobenzene-di-*p*-sulphonic acid, A., i, 615.
- bromination of phenols, A., ii, 112.
- chemical affinity, A., ii, 264, 590.
- the molecule of carbon and the supposed negative heat of formation of various carbon compounds, A., ii, 274.
- relationship between reactivity and concentration of sulphuric acid, A., ii, 650.
- Veitch, F. P.**, estimation of nitrogen in fertilisers containing nitrates, A., ii, 166.
- direct estimation of available phosphoric acid, A., ii, 166.
- estimation of alumina and ferric oxide in natural phosphates, A., ii, 577.
- Velsen, J. von**. See **Alfred Partheil**.
- Venable, Francis Preston**, nature of the change from violet to green in solutions of chromium salts, A., ii, 349.
- Venturi**. See **Henri Moissan**.
- Venturoli, Giuseppe**, detection of nitroprussides in cases of poisoning, A., ii, 174.
- Venturoli, Giuseppe**, determination of the hardness of water, A., ii, 579.
- Verein für chemische Industrie in Mainz**, estimation of formaldehyde, A., ii, 326.
- Vernon, Horace Middleton**, death temperature of marine organisms, A., ii, 93.
- Verschaffelt, J. E.**, deviations from Boyle's law of mixtures of hydrogen and carbon dioxide, A., ii, 192.
- Vertun**, hydrocele fluid, A., ii, 152.
- Vespignani, G. B.** See **Giacomo Carrara**.
- Vieth, Paul**, sesamé oil reaction of pure butter, A., ii, 236.
- feeding experiments with crushed palm kernels, A., ii, 682.
- Vignier**, chemical fertilisation of eggs, A., ii, 608.
- Vignon, Léo**, nitrocelluloses, A., i, 589.
- oxycelluloses of cotton, flax, hemp, and rhea, A., i, 628.
- reduction of nitrocelluloses, A., i, 629.
- Vignon, Léo**, and **F. Gerin**, acetyl derivatives of cellulose and oxycellulose, A., i, 629.
- Vignon, Léo**, and **Louis Meunier**, rapid method of estimating carbon dioxide in gaseous mixtures, A., ii, 314.
- Vigouroux, Émile**, molybdenum silicide, A., ii, 144.
- Villard, P.**, chemical action of X-rays, A., ii, 125.
- radiations from radium, A., ii, 381.
- permeability of molten silica to hydrogen, A., ii, 652.
- Ville, Jules**, and **Charles Astro**, new compounds of mercuric chloride and antipyrine, A., i, 362.
- new mercuric haloid derivatives of antipyrine, A., i, 411.
- Villiers, Antoine**, and **Ernest Dumesnil**, estimation of ammonia and of nitrogen, A., ii, 310.
- Villiger, Victor**. See **Adolf von Baeyer**.
- Vincent, E.**, titration of potassium iodide, A., ii, 166.
- estimation of mercuric cyanide, A., ii, 174.
- Vincent, Swale**. See **W. A. Osborne**.
- Viola, Carlo**, feldspar studies, A., ii, 663.
- Viola, Carlo**, and **E. H. Krauss**, sedorowite, A., ii, 662.
- Virchow, C.**, retention of phytosterol in the animal body after feeding with cotton-seed oil, A., ii, 93.
- Vischner, Emil**. See **Max Bamberger**.
- Vitali, Dioscoride**, passage into the urine of chloroform administered by inhalation, A., ii, 31.

- Vitali, Dioscoride**, detection of nitric acid in cadaveric matter, A., ii, 46.
 — detection of "saccharin" in wines, A., ii, 57.
 — detection of urochloralic acid in urine after administration of chloral hydrate, especially in cases of poisoning, A., ii, 115.
 — action of bromine on copper salts in presence of alkali hydroxides; test for copper salts, A., ii, 208.
 — detection of copper, A., ii, 247.
 — formation of alcohol in the putrefaction of proteids free from carbohydrates, A., ii, 297.
 — chemico-toxicology of sulphonal and analogous compounds, A., ii, 774.
- Vitali, Dioscoride, and Cesare Stroppa**, chemico-toxicological study of coniine, A., ii, 639.
- Vittonet, Herni**, *s*-dinitrodixylylcarbamides and dinaphthylcarbamides, A., i, 153.
 — aromatic carbimides, A., i, 153.
- Vivian, Alfred**. See *S. Moulton Babcock*.
- Voegel, Adolph L.**, electrolytic reduction of potassium chlorate, A., ii, 185.
- Vogt, Johan H. L.**, vanadium in rocks, A., ii, 150.
 — marbles, A., ii, 784.
- Vogtherr, M.**, ammonium dithiocarbonate as a substitute for hydrogen and ammonium sulphides, A., ii, 241.
- Volhard, J.** See *Oscar Kellner*.
- Volhard, Jakob**, action of iodides and hydriodic acid on sulphur dioxide, A., ii, 650.
- Vongerichten, Eduard**, *α*-dinitrophenylpyridine chloride, A., i, 51.
 — non-nitrogenous decomposition products of morphine, VI., A., i, 248.
 — identity of dimethylmorphol and of 3:4-dimethoxyphenanthrene, A., i, 488.
 — luteolin methyl ether as a product of the hydrolysis of a glucoside from parsley, A., i, 681.
- Vorländer, Daniel**, hydrogenised derivatives of diphenylmethane and triphenylmethane, A., i, 99.
- Vorländer, Daniel, and Fritz Kalkow**, formaldehyde derivative of dihydroresorcinol, A., i, 99.
- Vorländer, Daniel, and C. Koettwitz**, formation of indigotin from ethyl anthranilate, A., i, 649.
- Vorländer, Daniel, and A. T. de Moulpiéd**, action of sodium ethoxide on ethyl anilinoacetate, A., i, 644.
- Vorländer, Daniel, and Rudolf von Schilling**, isomeric mono-esters of phenylglycine-*o*-carboxylic acid, A., i, 295.
 — preparation and properties of anhydrous perchloric acid, A., ii, 340.
- Vorländer, Daniel, and O. Strauss**, compounds of dihydroresorcinol with aromatic aldehydes, A., i, 100.
- Vorländer, Daniel, and H. Weissbrenner**, action of ammonia and aniline on phenylglycine-*o*-carboxylic acid, A., i, 295.
 — acetylation of phenylglycine-*o*-carboxylic acid, A., i, 295.
- Votoček, Emil**, rhodose, a new sugar of the methylpentose series, A., i, 332.
 — sugars of some glucosides, A., i, 355.
- Votoček, Emil, and J. Šebor**, arabic acid from beetroot, A., i, 208.
- Votoček, Emil, and E. Zeníšek**, electrolytic modification of Sandmeyer's and Gattermann's reactions, A., i, 19.
- Vriens, Johannes Gerardus Cornelis**, experiments on absorption, A., ii, 202.
- Vulte, Hermann T., and Harriet Winfield Gibson**, chemistry of corn oil [maize oil], A., ii, 697.

W.

- Waage, Peter**, obituary notice of, T., 591.
- Waals, Johannes Diderik van der**, accurate determination of the molecular weight of gases from their density, A., ii, 134.
- Wachholz, Leo**, chemical detection of carbonic oxide in blood, A., ii, 169.
- Wacker, Leonhard**, evolution of chlorine by the aid of manganese dioxide, A., ii, 470.
- Wade, E. M., and M. L. Wade**, qualitative test for boric acid, A., ii, 758.
- Wade, John**, the constitution of hydrogen cyanide, P., 1900, 156.
- Wagner, Georg, and Wacław Brickner**, relation of pinene hydrochloride and hydriodide to bornyl chloride and iodide, A., i, 46.
 — bornylene, a new terpene, A., i, 554.
- Wagner, Paul**, basic slag for spring manuring, A., ii, 507.
- Wahl, Fritz**, carbonic oxide in tobacco smoke, A., ii, 221.
- Walbaum, Heinrich**, civet, jasmine, and oil of roses, A., i, 509.
 — occurrence of methyl methylantranilate in oil of mandarins, A., i, 595.

- Walbaum, Heinrich**, occurrence of phenylethyl alcohol in rose blossoms, A., i, 645.
- Walbaum, Heinrich**, and **Karl Stephan**, German rose oil, A., i, 677.
- Walden, Paul**, resolution of racemic compounds into their active components, A., i, 7.
- behaviour of malic acid when heated, A., i, 10.
- optical rotation of malic acid in the pure state and in solution, A., i, 11.
- double thiocyanates and cyanides, A., i, 430.
- a new inorganic dissociative solvent, A., ii, 10.
- Walder, Franz**. See **Ernst Täuber**.
- Waldvogel**, formation of acetone in the body, A., ii, 153.
- Walker, C.** See **William Henry Perkin, jun.**
- Walker, James**, the constitution of camphoric acid, T., 390; P., 1900, 60.
- estimation of atmospheric carbon dioxide, T., 1110; P., 1900, 164.
- velocity of graded reactions, A., ii, 198.
- relation between the dissociation constant of weak acids and the hydrolysis of their alkali salts, A., ii, 268.
- Walker, James**, and **William Cormack**, the dissociation constants of very weak acids, T., 5; P., 1899, 208; discussion, P., 208.
- campholytic and isolauronic acids, T., 374; P., 1900, 58.
- Walker, James**, and **John K. Wood**, preparation and properties of solid ammonium cyanate, T., 21; P., 1899, 209.
- configuration of the camphoric acids, T., 383; P., 1900, 59.
- Wallace, George B.**, and **Arthur R. Gushny**, intestinal absorption and saline cathartics, A., ii, 31.
- Wallach, Otto**, methylcyclohexanone, A., i, 179.
- condensation products of rubeanic acid [dithio-oxamide] with aldehydes and secondary bases, A., i, 210.
- phenylisobutyric and tolylisobutyric acids, A., i, 229.
- Wallach, Otto** [with **Eugen von Biron**, **Th. Böcker**, **Ad. Gilbert**, **W. Rath**, and **Herm. Umbgrove**], terpenes and ethereal oils; ring disruption and ring formation among terpene derivatives, A., i, 44.
- Wallach, Otto** [with **Edgard Neumann**, and **Wilhelm von Westphalen**], compounds of the fenchone series, A., i, 241.
- Wallach, Otto** [and in part **L. Ottemann**], terpenes and ethereal oils; ring disruption among cyclic ketones, A., i, 589.
- Wallach, Otto**, and **A. Schäfer**, oxidation of pinene, A., i, 241.
- Wallach, Otto**, and **A. Tewes**, mixed diazoamino-compounds, A., i, 264.
- Waller, Augustus D.**, comparative action of veratrine alkaloids on muscle and nerve, A., ii, 425.
- Walter, A. A.**, secretion of the pancreas, A., ii, 553.
- Walther, J.**, valuation of lemon oil, A., ii, 173.
- Walther, Reinhold von**, and **J. Clemen**, 2-methylketole, A., i, 408.
- Walther, Reinhold von**, and **A. Stenz**, action of chloroacetic acid and chloroacetone on thiocarbonylides and thiosemicarbazides, A., i, 569.
- Walther, Reinhold von**, and **A. Wetslich**, action of aldehydes on phenylacetic acid and benzyl cyanide and some of its derivatives with the formation of stilbene and stilbene derivatives, A., i, 438.
- Wang, Eyrin**, estimation of urinary indican, A., ii, 122.
- Want, G. van der**. See **Adolf C. Geitel**.
- Warburg, Emil**, formation of ozone by a point-discharge in oxygen, A., ii, 721.
- Ward, Harry Marshall**, and **Joseph Reynolds Green**, a sugar bacterium, A., ii, 33.
- Waring, R.** See **William Richard Eaton Hodgkinson**.
- Warington, Robert**, recent researches on nitrification, P., 1900, 65.
- basic constituents of crops, A., ii, 569.
- Warren, Charles Hyde**. See **Samuel Lewis Penfield**.
- Warth, H.**, composition of soot from mineral coal, A., ii, 728.
- Washington, Henry S.**, analyses of Italian volcanic rocks, A., ii, 27, 220.
- statement of rock analyses, A., ii, 598.
- Waterhouse, James**, sensitiveness of silver and of some other metals to light, A., ii, 585.
- Watson, David**, obituary notice of, T., 603.
- Watson, Thomas L.**, weathering of diabase in Virginia, A., ii, 488.
- Watters, L. L.** See **John Alexander Mathews**.
- Wavelet**, estimation of potassium by phosphomolybdic acid, A., ii, 758.

- Way, Arthur F.** See *Franke Stuart Havens*.
- Weber, Carl Otto**, indiarubber, A., i, 353.
- Weber, H. A.**, testing soil for application of commercial fertilisers, A., ii, 165.
- Wechsler, Elkan.** See *Raphael Meldola*.
- Wedekind, Edgar**, characteristics of stereoisomeric ammonium salts, A., i, 155.
- stereochemical observations on the reaction between picric chloride and aromatic amines, A., i, 216.
- new synthesis of ketones, A., i, 665.
- Wedel, Jean**, interaction of hydrazine hydrate with certain lactones, A., i, 363.
- Wedell-Wedellsborg, P. S.**, [validity of Maxwell's equations], A., ii, 254.
- refutation of [Poynting's theorem], A., ii, 519.
- Wedelstädt, Ernst von.** See *Wilhelm Traube*.
- Wedomeyer, K.** See *Oscar Kellner*.
- Wedenaki, Nicolai E.**, the properties of nerve under the influence of certain poisons, A., ii, 739.
- Wegscheider, Rudolf**, esterification of camphoric acid, II., A., i, 10.
- esterification of unsymmetrical polybasic acids. I. Esterification of nitroterephthalic acid, A., i, 657.
- kinetics of reactions with auxiliary reactions, A., ii, 199.
- molecular transformation of cinchonine; an addition to the theory of catalytic action, A., ii, 532.
- Wegscheider, Rudolf**, and **Karl Bittner**, esterification of unsymmetrical polybasic acids. II. Esterification of bromo- and hydroxy-terephthalic acids, A., i, 658.
- Wehmer, Carl**, "Chinese yeast," and the so-called *Amlyomyces* (*Mucor Rouxi*), A., ii, 743.
- Wehnert, H.** See *Adolf Emmerling*.
- Wehrlin, H.** See *Richard Lorenz*.
- Weibull, Mats**, westanite, pyrophyllite, and kaolinite from Westana, Sweden, A., ii, 286.
- ransäitite, A., ii, 287.
- Weidel, Hugo**, and **Jacques Pollak**, nitroso-derivatives of the phloroglucinol ethers, A., i, 290.
- action of nitrous acid on methylphloroglucinol, A., i, 291.
- Weidel, Hugo**, and **Franz Wenzel**, condensation of homologous phloroglucinols with salicylaldehyde, A., i, 308.
- Weigel, G.** See *Alexander Tschirch*.
- Weigert, Richard**, changes in the substances in the blood which are soluble in ether, A., ii, 738.
- Weigmann, H.**, in feeding with sesamé cake, do substances which give the Bandouin reaction appear in the butter? A., ii, 40.
- [testing butter for oil of sesamé], A., ii, 56.
- Weil, St.** See *René Thomas-Mamert*.
- Weiler, Max**, explanation of the Würtz-Fittig synthesis. IV. Bromomesitylene and sodium; mesityl bromide and sodium, A., i, 213.
- synthesis of homologues of diphenylmethane by oxidation of toluene and its homologues, A., i, 283.
- Weinland, Ernst**, the lactase of the pancreas, A., ii, 93.
- Weinland, Rudolph F.**, and **O. Köppen**, acid iodates containing fluorine, and caesium fluoroperiodate, A., ii, 139.
- double salts of ferric and aluminium fluorides with fluorides of bivalent metals, A., ii, 143.
- Weinland, Rudolph F.**, and **H. Prause**, compounds of telluric acid with the iodates, A., ii, 399.
- Weisberg, Julius**, solubility of lime in saccharine solutions, A., i, 628.
- Weiss, Bruno.** See *Max Busch*.
- Weissberg, J.** See *Carl Engler*.
- Weissbrenner, H.** See *Daniel Vorländer*.
- Weisweiler, Gustav**, ethylphloroglucinol and other derivatives of ethylbenzene, A., i, 291.
- Welde, R.** See *Karl Auwers*.
- Wells, Harry Edward.** See *Johannes Wislicenus*.
- Welmans, Paul**, estimation of vanillin, A., ii, 327.
- Hübl's iodine-addition method, A., ii, 514.
- Welmans' phosphomolybdate test, A., ii, 697.
- Wender, Newman**, and **Georg Gregor**, testing lemonade essences. I. Essence of lemon and of bitter orange, A., ii, 767.
- Wengel.** See *Carl Adam Bischoff*.
- Wenner, P.** See *Fritz Ullmann*.
- Wenzel, Franz.** See *Josef Herzig* and *Hugo Weidel*.
- Wenzel, G.**, action of bromine and carbon disulphide on sodium methylene compounds, A., i, 536.
- Wenzel, G.** See also *Hugo Simonis*.
- Werdenberg, H.** See *Robert Gnehm*.
- Werder, J.**, estimation of fatty matter in butter by Gerber's process, A., ii, 252.

- Werder, J.**, estimation of mercury in urine, A., ii, 689.
- Werenskiöld, Fr.**, analyses of Norwegian hay, A., ii, 304.
- Werner, Alfred, F. Bräunlich, R. Klien, and Herbert Müller**, constitution of inorganic compounds. XX. Thio-cyanocobalt salts and structural isomerides, A., i, 86.
- Werner, Alfred, and H. E. Conrad**, optically active *trans*-hexahydrophthalic acid, A., i, 100.
- Werner, Alfred, and Th. Herberger**, formation of ring compounds by elimination of aromatic nitro-groups, A., i, 57.
- Werner, Alfred, and Edmund Stiasny**, nitro-derivatives of azo-, azoxy-, and hydrazo-benzene, A., i, 194.
- Wertheimer, Alfred.** See **Charles I. Tyrer**.
- Wesenberg, G.**, Ehrlich's diazo-reaction, A., ii, 776.
- Wesener, John A.**, Koppe's theory of the formation of hydrochloric acid in the stomach, A., ii, 92.
- Wessely, Leo**, an aldol from isobutaldehyde and formaldehyde, A., i, 428.
- West, Charles Alfred**, the dissociation constant of azoimide (hydrazoic acid), T., 705; P., 1900, 74.
- West, John H.** See **Thomas Martin Lowry**.
- Weston, Robert Spurr**, apparatus for the determination of ammonia in water by the Wanklyn method, and total nitrogen by the Kjeldahl method, A., ii, 685.
- Westphalen, Wilhelm von.** See **Ott. Wallach**.
- Wesselsky, Julius von**, volumetric estimation of bromides in presence of iodides and chlorides, A., ii, 436.
- Wetzel, G.**, decomposition products of conchiolin, A., i, 71.
- organic substance of the shells of *Mytilus* and *Pinna*, A., ii, 555.
- Wetzlich, A.** See **Reinhold von Walther**.
- Wheeler, Henry Lord**, sodium salts of the amides, A., i, 492.
- Wheeler, Henry Lord**, [with **Munson D. Atwater, Treat B. Johnson, and Bayard Barnes**], rearrangement of imino-ethers, II., A., i, 298.
- Wheeler, Henry Lord, and Bayard Barnes**, [and in part **G. K. Dustin, Leeds Mitchell, Harry Le B. Gray, Henry A. North, and W. H. Buell**], molecular rearrangement of thioncarbamic, thioncarbanilic, and thioncarbazinic esters; β -alkyl- α -diketotetrahydrothiazoles, A., i, 564.
- Wheeler, Henry Lord, and Treat B. Johnson**, behaviour of acylthioncarbamic esters with alkyl iodides and amines; benzoyliminothiocarbonic esters, acyclic benzoyl- ψ -carbamides, and benzoylcarbamides, A., i, 632.
- Wheeler, Henry Lord, and W. Murray Sanders**, [and in part **Bayard Barnes**], ureaimino-, thioureaimino-, and acylthioureaimino-esters, and urea-amidines, A., i, 563.
- Wheeler, Henry Lord, and William Valentine**, action of bromine on *m*-chloro-, *m*-bromo-, and *m*-iodo-anilines, II., A., i, 25.
- Wheeler, Homer J., C. L. Sargent, and Burt L. Hartwell**, amount of humus in soils, and the percentage of nitrogen in the humus as affected by the application of air, slaked lime, and other substances, A., ii, 104.
- — — chemical methods for ascertaining the lime requirement of soils, A., ii, 432.
- Wheeler, P. M.** See **D. F. Calhane**.
- Whetham, W. C. Dampier**, coagulative power of electrolytes, A., ii, 62.
- dissociation in dilute solutions at 0°, A., ii, 890.
- White, Alfred H.**, burette for accurate gas analysis, A., ii, 571.
- White, O. E.** See **W. A. Macleod**.
- Whiteley, Martha Annie**, the oxime of mesoxamide and some allied compounds, T., 1040; P., 1900, 145.
- Whitney, Willis Rodney**, nature of the change from violet to green in solutions of chromium salts, A., ii, 211.
- Widman, Oskar**, usnic acid, A., i, 235, 347.
- Widtsøe, John A., and Bernhard Tollens**, arabinose, xylose, and fucose from tragacanth, A., i, 207.
- reactions of methylfurfuraldehyde and methylpentosans, A., i, 244.
- Wiedeberg, Otto**, theory of diffusion, A., ii, 194.
- Wiedermann, Fritz.** See **Theodor Lan-ser, and Carl Liebermann**.
- Wiegand, C.** See **Richard Jos. Meyer**.
- Wiegand, Otto.** See **Heinrich Limp-richt**.
- Wiegmann, D.** See **Eugen Prior**.
- Wiener, Hugo**, decomposition and formation of uric acid in the body, A., ii, 153.
- Wight, Otis B.** See **John van Deuburg**.
- Wijs, J. J. A.**, Macassar oil, A., ii, 252.
- determination of the iodine value, A., ii, 876.
- Wikander, Hjalmar**, derivatives of 5:6:8-trimethylquinoline, A., i, 310.

- Wildermann, Meyer**, determination of freezing points in dilute solutions, A., ii, 131.
- real and apparent freezing points and cryoscopic methods, A., ii, 191.
- the velocity of reaction before complete equilibrium and before transition points; true meaning of the law of chemical equilibrium of heterogeneous systems; reactions in heterogeneous systems, A., ii, 200.
- freezing point method in dilute solutions, and the theory of solutions, A., ii, 262.
- Wiley, Harvey Washington**, separation of proteins from flesh-bases by means of chlorine and bromine, A., ii, 122.
- Wilfarth, H.**, assimilation by sugar-beet and estimation of available nutritive matter in arable soil, A., ii, 163.
- does nitrogenous manure injure succeeding crops when applied to sugar-beet? A., ii, 366.
- Wilfarth, H.**, and **G. Wimmer**, vegetation experiments with sugar-beet, A., ii, 365.
- Willip, J.** See (*Prince*) **Boris B. Galitsin**.
- Willenz, M.**, estimation of copper, A., ii, 315.
- Willgerodt, [Heinrich] Conrad [Christoph]**, preparation of iodoso- and iodoxy-compounds, A., i, 339.
- derivation and rational nomenclature of the quinopyridines, A., i, 610.
- Willgerodt, Conrad**, and **Vincent Allen Howells**, as-iodoso-, -iodoxy-, and -iodonium-compounds derived from *m*-xylene, A., i, 338.
- Willgerodt, Conrad**, and **Heinrich Eggatz**, iodoso-, iodoxy-, and iodonium-compounds derived from iodo- and chloriodo-mesitylene, A., i, 432.
- Willgerodt, Conrad**, and **Peter Schlöser**, 1-naphthyliodochloride, 1-iodosonaphthalene, 4:4'-diiodo-1:1'-dinaphthyl, 1-naphthylphenyliodonium hydroxide and derivatives thereof, A., i, 282.
- Williams, P.** See **Harry Mcdforth Dawson**.
- Williams, Rowland**, maize oil, A., ii, 532.
- iodine and bromine values of oils and fats, A., ii, 633.
- Williams, William Arthur**. See **Raphael Meldola**.
- Wills, A. P.** See **Otto Liebknecht**.
- Willstätter, Richard**, action of halogens on dimethylpiperidine, A., i, 249.
- action of potassium permanganate on bases, A., i, 404.
- Willstätter, Richard**, synthesis of hygric acid, A., i, 405.
- Willstätter, Richard**, and **Adolf Bode**, ketones of the tropine group. XIV. Alkali salts of amino-ketones, A., i, 245.
- Willstätter, Richard**, and **Fritz Igauer**, ketones of the tropine group. XIII. Hydroxymethylenetropinone, A., i, 244.
- reduction of tropinone to tropine and tropane, A., i, 404.
- action of hypochlorous acid on tertiary amines, A., i, 458.
- Willstätter, Richard**, and **Rudolf Lessing**, benzenesulphonamino-compounds of primary bases, A., i, 304.
- Wilms, Johann**, influence of the amount of water and of nutritive substances in soil on the activity and development of potatoes, A., ii, 164.
- Wilson, D. R.** See **Robert Luther**.
- Wilson, Harold A.**, formation of oceanic salt deposits, particularly of the Staassfurt beds. XVII. A relationship between the composition of solutions of sodium chloride and potassium chloride saturated at 25°, A., ii, 285.
- velocity of solidification and viscosity of supercooled liquids, A., ii, 712.
- Wimmer, G.** See **H. Wilfarth**.
- Wind, C. H.**, Gibbs' phase rule, A., ii, 197.
- Windaus, Adolf**. See **Emil Fischer**.
- Windisch, Richard**, action of calcium hydroxide on germination, A., ii, 614.
- Windisch, Richard**. See also **Thomas Kosutány**.
- Windisch, Wilhelm**, and **B. Schellhorn**, proteolytic enzyme of germinated barley, A., i, 712.
- Winkler, Clemens [Alexander]**, preparation of hydrogen sulphide and of its solution, A., ii, 398.
- supposed transformation of phosphorus into arsenic, A., ii, 476.
- possibility of the transference of metals in igneous rocks through the agency of carbon monoxide, A., ii, 598.
- Winogradsky, Sergei**, and **V. Omeliansky**, influence of organic substances on the work of nitrifying organisms, A., ii, 96.
- Winter, Berthold**. See **Alois Fischer**.
- Winter, Ernst**. See **Johannes Thiele**.
- Winter, H.** See **Wilhelm Kerp**.
- Winter, Justin**, and **Fallose**, relationship between the nitrogen and chlorides of the stomach contents, A., ii, 554.
- Winter, K.** See **A. Bömer**.

- Winterberg, Heinrich**, action of nicotine on respiration and circulation, A., ii, 424.
- Winternitz, Hugo**, action of certain derivatives of morphine on respiration in man, A., ii, 221, 489.
- Winterstein, Ernst**. See **Ernst Schulze**.
- Wintgen, M.**, estimation of formaldehyde in the air, A., ii, 117.
- Winther, Chr.**, britholite, a new mineral, A., ii, 413.
- schizolite, a new mineral, A., ii, 413.
- Winton, A. L.**, detection of coal-tar dyes in fruit products, A., ii, 776.
- Wintrebert, L.**, osmyloxalates, A., i, 543.
- Wirthle, F.**, tin in preserved meat; its estimation and the state in which it occurs, A., ii, 512.
- Wischin, Rudolf**, cyclic polymethylenes of [Russian] petroleum, A., i, 146.
- Wislicenus, Hans**, detection of sulphur dioxide in the atmosphere of the Tharandt Forest, A., ii, 38.
- Wislicenus, Johannes** [with **Bruno Löwenheim, Paul Schmidt**, and **Harry Edward Wells**], isomeric forms of dibenzoylmethane, A., i, 37.
- Wislicenus, Wilhelm**, influence of the solvent on the constitution of ethyl acetoacetate and similar substances, A., i, 9.
- ethyl fluoreneoxalate, and indeneoxalate, A., i, 346.
- isomerism of the formylphenylacetic esters, A., i, 597.
- Wislicenus, Wilhelm**, and **Max Goldschmidt**, molecular rearrangement of imino-ethers by heat, A., i, 435.
- Wissell, L. von**, changes in the weights of artificial manures when exposed to air, A., ii, 683.
- comparative estimations of nitrogen in saltpetre, A., ii, 685.
- Witham, Ernest**. See **George Yeung**.
- Witt, Otto Nikolaus**, and **Walker Theel**, the cerite earths, A., ii, 403.
- Wittorf, Nicolaus M.**, addition of hypochlorous and hypobromous acids to acetylene and to its monosubstituted derivatives, A., i, 421.
- Wlassoff, A.** See **Alexander P. Sabaneff**.
- Wobbo, Willy**, ferric oxide solution obtained by dialysis, A., ii, 281.
- Wöhlk, Alfred**, acrylic acid from glycerol, A., i, 425.
- Wöhlk, Alfred**. See also **Einar Billmann**.
- Wörner, Emil**, estimation of uric acid based on precipitation as ammonium urate, A., ii, 251.
- Wörner, Emil**, phosphotungstic acid as a reagent for potassium, A., ii, 370.
- Wohl, Alfred**, degradation of *l*-arabinose, A., i, 140.
- conversion of nitrobenzene into *o*-nitrophenol by means of caustic potash, A., i, 157.
- triazan derivative from nitrosoformylphenylhydrazine, A., i, 698.
- Wohl, Alfred**, and **W. Emmerich**, semi-aldehyde of malonic acid, A., i, 627.
- Wohl, Alfred**, and **Carl Neuberg**, acid esters of boric acid, A., i, 131.
- Wohl, Alfred**, and **Carl Oesterlin**, benzylhydrazine, A., i, 698.
- Wohl, Alfred**, and **Hans Schiff**, diazohydrazides and bisdiazotetrazones (octazones), A., i, 706.
- Wohlgemuth, Julius**. See **Ernst Bendix**.
- Wohltmann, Ferdinand**, experiments with German, English, and French varieties of mangels, A., ii, 501.
- Wohlwill, Heinrich**, electrolysis of solutions of alkali chlorides, A., ii, 400.
- electrolytic formation of chlorates, A., ii, 471.
- Wolf, C. G. L.**, melting point of chloral hydrate, A., i, 274.
- melting point of ethyl formylphenylacetate, A., i, 345.
- electrolysis of sodium chloride, A., ii, 382.
- Wolf, Otto**. See **Hans Kreis**.
- Wolfs, O.** See **Robert Paschorr**.
- Wolff, Fr.** See **Bruno Taake**.
- Wolff, H.** See **Friedrich Kehrman**.
- Wolff, John E.**, hardystonite and zinschefferite from Franklin furnace, New Jersey, A., ii, 735.
- Wolff, Jules**, constituents of chicory, A., ii, 37.
- improvement in Trillat's process for the detection of methyl alcohol in alcohols, A., ii, 111.
- colour reaction for tartaric acid and its compounds, A., ii, 115.
- colour reaction for the detection of benzidine and tolidine, A., ii, 119.
- estimation of formaldehyde, A., ii, 373.
- new indicator for acidimetry; estimation of boric acid, A., ii, 435.
- Wolff, Kurt**, denitrification, A., ii, 98.
- denitrification and fermentation, A., ii, 298.
- Wolff, Ludwig**, substitution products of tetronic acid, A., i, 582.
- Wolff, Ludwig**, and **Eduard Fertig**, iodotetronic acid and sulphotetronic acid, A., i, 585.

- Wolf, Ludwig** [and in part with **Eduard Fertig**, and **A. Lüttringhaus**], 4-hydroxypyrazole and its derivatives, A., i, 691.
- Wolf, Ludwig**, and **Willy Herold**, behaviour of α -methyltetrionic acid towards diazobenzene chloride, A., i, 585.
- Wolf, Ludwig**, and **A. Lüttringhaus**, nitrotetrionic and aminotetrionic acids, and their derivatives, A., i, 583.
- phenylhydrazone of diketobutyrolactone, A., i, 584.
- Wolf, W.** See **Karl Auwers**.
- Wolfenstein, Richard**. See **Leonard Mamlock**.
- Wolkoff, Alesci A.**, and **Boris N. Menschutkin**, preparation of saturated hydrocarbons, A., i, 321.
- action of zinc dust on trimethylene bromide, A., i, 423.
- Wollny, Ewald**, effect of carbon disulphide on the fertility of arable soil, A., ii, 504.
- manurial experiments with green and dead plants and parts of plants, A., ii, 683.
- Wolowski, C.**, estimation of chlorine in bleaching powder, A., ii, 165.
- Wood, John K.** See **James Walker**.
- Wood, Thomas Barlow**. See **Richard Haliburton Adie**.
- Woods, Albert F.**, decomposition of chlorophyll by oxidising enzymes, A., ii, 234.
- Woringer, Benedikt**, vapour pressure of a series of benzene compounds, A., ii, 709.
- Woy, Rudolf**, Stutzer and Hartleb's process for the estimation of combined carbon dioxide (calcium carbonate) in soils, A., ii, 170.
- peat-meal molasses, A., ii, 682.
- [estimation of sugar in] peat-meal molasses, A., ii, 695.
- Wresky, M.**, thermal capacity and colour changes of solutions of cobalt chloride, A., ii, 63.
- Wright, Fred. Eug.**, alkali-syenite from Massachusetts, A., ii, 663.
- Wright, Robert**. See **E. H. Farr**.
- Wróblewski, Augustin**, Buchner's yeast extract, A., ii, 157.
- Wülfing, Ernst A.**, analysis of rocks, A., ii, 25.
- Wulff, G. F.**, oxidation products of cotarnine, A., i, 607.
- Wyrouboff, Grégoire N.**, estimation of sulphuric acid in the presence of iron, A., ii, 166.
- Y.**
- Yates, J.** See **Alexander William Gilbody**, and **William Henry Perkins, jun.**
- Young, George**, and **Ernest Witham**, C-derivatives of hydroxytriazole, T., 224; P., 1900, 5.
- hydrolysis of semicarbazones, P., 1900, 73.
- Young, Sydney**, vapour pressures, specific volumes, and critical constants of *n*-octane, T., 1145; P., 1900, 166.
- the law of Cailletet and Mathias and the critical density, A., ii, 711.
- Young, Sydney**, and **Emily C. Fortey**, note on the refraction and magnetic rotation of hexamethylene, chlorohexamethylene, and dichlorohexamethylene, T., 372; P., 1900, 44.
- vapour pressures, specific volumes, and critical constants of diisopropyl and diisobutyl, T., 1126; P., 1900, 165.
- Young, William J.** See **Jocelyn Field Thorpe**.
- Yvon, Paul**, amylase, A., i, 196.
- Z.**
- Zängerle**, pseudomucin from ovarian cysts, A., ii, 675.
- Zaharia, Al. J.**, solubility of camphor in hydrochloric acid, A., i, 106.
- Zahn, O.** See **Oscar Kellner**.
- Zahn, Oskar**, *o*-aminosalicylic acid, A., i, 549.
- Zaleski, J.** See **Marcellus Nencki**, and **Sergei Salaskin**.
- Zalozieski, Roman**, and **Ludwig Gans**, hydrocarbons with high melting points from the last distillates of petroleum, A., i, 593.
- Zambonini, Ferruccio**, magnetite from near Rome, A., ii, 147.
- olivine from Latium, A., ii, 149.
- two new hydrosilicates, A., ii, 149.
- sanidine from Monte Cimino, Rome, A., ii, 603.
- pyroxene from Latium, A., ii, 662.
- Zaudy, See E. Schreiber**.
- Zawidzki, Jan von**, thiocyanocobalt-ammonium compounds, A., i, 210.
- composition of the surface layers of aqueous solutions, A., ii, 713.
- Zay, C.**, [composition of the flowers of the] hollyhock, A., ii, 563.
- Zecchini, Mario**, estimation of copper sulphate, A., ii, 762.
- Zecchini, Mario**, and **R. Nuvoli**, manurial experiments on irrigated meadows, A., ii, 605.

- Zega, Alexander**, *Agaricus campestris*, A., ii, 498.
 — "manur," A., ii, 503.
- Zega, Alexander**, and **R. Majstorović**, maize as food in Serbia, A., ii, 39.
- Zehenter, Josef**, behaviour of uranyl acetate and some of its double salts towards water, A., i, 424.
- Zeleny, John**, velocity of the ions produced in gases by Röntgen rays, A., ii, 587.
- Zembruski, K. von**. See **Hans Labhardt**.
- Zeníšek, E.** See **Emil Votoček**.
- Zernoff, W.**, iodation of fatty acids, A., i, 327.
- Zetsche, F.**, estimation of [dissolved] oxygen in water, A., ii, 166.
- Zeynek, Richard von**, formation of methæmoglobin, A., i, 196.
 — hæmatin and hæmochromogen obtained by the use of pepsin-hydrochloric acid, A., i, 711.
 — human bile, A., ii, 29.
- Zielstorff, W.** See **Oscar Kellner**.
- Zinke, [Ernst Carl] Theodor**, action of nitrous acid on bromo- and chloro-derivatives of phenols, A., i, 545.
- Zinke, Theodor**, and **Ph. Schwarz**, aziminole, A., i, 527.
- Zinke, Theodor, F. Stoffel**, and **E. Petermann**, ketochlorides and quinones of heterocyclic compounds and their products of change: ketochlorides and quinones of aziminobenzene, A., i, 524.
- Zsigmondy, Richard**, nature of so-called colloidal metallic solutions, A., ii, 397.
- Zuckmayer, F.** See **Fritz Anselm**.
- Zulkowski, Karl**, setting of gypsum, A., ii, 76.
 — constitution of glass and allied products, A., ii, 595.
 — composition of bottle glasses, A., ii, 654.
- Zunino, V.**, action of potassium hydroxide on epichlorhydrin in the presence of alcohols, II., A., i, 535.
 — new hydrate of alumina, A., ii, 348.
 — dehydration of selenite and hydration of anhydrite, A., ii, 479.
- Zunino, V.** See also **Gaetano Magnanini**.
- Zunts, Nathan**, and **Ussow**, origin of volatile fatty acids in butter, A., ii, 669.
- Zwenger, Rud.** See **Zdenko Hanns Skraup**.
- Zwick, Karl G.**, colouring matter of annatto, A., i, 513.

INDEX OF SUBJECTS.

ABSTRACTS. 1900. Parts I & II.

(Marked A. i and A. ii respectively); and also to Transactions, 1900 (marked T.); and to Proceedings of the Session 1899—1900; Nos. 213 to 226, Nov., 1899—June, 1900 (marked P.).

A.

- Abienic, α - and β -Abietinolic and Abietolic acids and Abietoresen** (TSCHIRCH and WEIGEL), A., i, 679.
- Abies canadensis*, balsam of** (TSCHIRCH and BRÜNING), A., i, 678.
- Abies pectinata*, balsam of** (TSCHIRCH and WEIGEL), A., i, 679.
- Absorption in the small intestine** (COHN-HEIM), A., ii, 289.
- of carbohydrates, fats, and proteids (MOSSO), A., ii, 605.
- of fat (HOFBAUER), A., ii, 605; (PFLÜGER), A., ii, 667; (FRIEDENTHAL), A., ii, 668.
- of fat in the large intestine (HAMBURGER), A., ii, 418.
- of iodides by the skin (GALLARD), A., ii, 419.
- of iron by the intestine (ABDERHALDEN), A., ii, 223, 289, 416.
- of free oxygen by normal urine (BERTHELOT), A., ii, 740.
- of saline solutions by the small intestine (WALLACE and CUSHNY), A., ii, 31.
- of sugars in the intestine (HEDON), A., ii, 223.
- Acacetin from *Robinia Pseudacacia* and its acetyl derivative** (PERKIN), T., 430; P., 1900, 45.
- Accumulators.** See Electrochemistry.
- Acet-.** See also Aceto-, Acetyl-, and under the Parent Substance.
- Acetal-*m*- and -*p*-cresol and -resorcinol** (FOSSE and ETTLINGER), A., i, 392.
- Acetaldehyde, heat of combustion and of formation of** (BERTHELOT and DELÉPINE), A., ii, 334.
- Acetaldehyde, condensation of, with propaldehyde** (SCHMALZHOFFER), A., i, 626.
- colour reaction of (RIMINI), A., ii, 56, 454; (LEWIN), A., ii, 179.
- detection of, in ether (BLASER), A., ii, 179.
- detection of, in fermentation vinegar (BÖTTINGER), A., ii, 773.
- Acetaldehyde, dibromo-, hydrate of** (WITTORFF), A., i, 421.
- Acetaldoxime, spectrum of** (HARTLEY and DOBBIE), T., 321; P., 1900, 14.
- Acetamide, action of chlorodinitrobenzene on** (KYM), A., i, 158.
- thiocyano- (FRIEDRICH and BECKURTS), A., i, 478.
- Acetanilide, action of dry silver oxide and ethyl iodide on** (LANDER), T., 737; P., 1900, 6, 90.
- Acetanilide, 3:5-dibromo-, 4:2- and 2:4-chlorobromo-, 2:4-bromonitro-, and 2:6:4-dibromonitro-** (CHATTAWAY and ORTON), A., i, 643.
- o*-mono- and 2:4-di-bromo- and -chloro-, formation of (CHATTAWAY and ORTON), T., 798; P., 1900, 112.
- m*-chloro-, action of bleaching powder on a hot acetic acid solution of (CHATTAWAY, ORTON, and HURTLEY), T., 804.
- substituted nitrogen chlorides from, and their transformation (CHATTAWAY, ORTON and HURTLEY), T., 800; P., 1900, 125.
- di*-, *tri*-, and *tetra*-chloro-derivatives of, from substituted nitrogen chlorides (CHATTAWAY, ORTON and HURTLEY), T., 800; P., 1900, 125.

- Acetanilide**, 3-chloro-4-bromo-, 3:4:6-chlorobromonitro-, 3:6-*di*bromo-, 3:4:6-*tri*bromo-, and 4-bromo-3-iodo- (WHEELER and VALENTINE), A., i, 25.
p-nitro-, electrolytic reduction of (SONNEBORN), A., i, 464.
- Acetanilide sodium hydroxide**, thio- (WHEELER), A., i, 493.
- Acetanilide**, *di*nitro- (MELDOLA and WECHSLER), T., 1172; P., 1900, 167.
- Acetic acid**, formation of, during the lactic acid fermentation of milk
 (BARTHEL), A., ii, 742.
 specific heat and heat of vaporisation of (LUGININ), A., ii, 334.
 freezing point of aqueous solutions of (DAHMS; DE COPPET), A., ii, 65.
 compounds of, with manganese (MEYER and BEST), A., ii, 77.
 detection of, in urine (ARNOLD), A., ii, 113.
 estimation of, in vinegar (DURIEU), A., ii, 322.
 estimation of propionic and butyric acids in (MUSPRATT), A., ii, 375.
- Acetic acid**, silver salt, electrolysis of (MULDER), A., ii, 724.
 uranyl salts and its double salts, behaviour of, towards water (ZEHEENTER), A., i, 424.
- Acetic acid**, *p*-aminobenzoylmethyl, *p*-acetylaminobenzoylmethyl, acetyl-amino-*o*-tolylmethyl, and *p*-amino-*m*-dimethylbenzoylmethyl esters (KUNCKELL), A., i, 663.
*di*bromo-*p*-hydroxymesityl ester (AUWERS, TRAUEN, and WELDE), A., i, 167.
 bromomethyl ester (HENRY), A., i, 537.
 ethyl ester, rate of hydrolysis of (GOLDSCHMIDT and MESSERSCHMITT), A., ii, 200.
 influence of sugars on the velocity of hydrolysis of (COHEN), A., ii, 716.
 solubility of, in aqueous salt solutions (EULER), A., ii, 196.
 methyl, ethyl, propyl, and isobutyl esters, rate of hydrolysis of, at various temperatures (PRICE), A., ii, 528.
 methyl ester, rate of hydrolysis of (COJAZZI), A., i, 327; (DE HEMPTINNE), A., ii, 199; (CAJOLA and CAPPELLINI), A., ii, 394.
 action of strong aqueous soda on, in presence of methyl alcohol and acetone (CUNIASSE), A., ii, 175.
 phenyl, *p*-tolyl, and thymyl esters, transformation of, into the corresponding benzoates (BODROUX), A., i, 224.
- Acetic acid**, picryl ester, action of diazomethane on (v. PECHMANN), A., i, 313.
 α -santalyl ester (v. SODEN), A., i, 677.
 trimethylenepicryl and pyrazolinedimethylenepicryl esters (v. PECHMANN), A., i, 313.
- Acetic acid**, amino-. See Glycine.
 bromo- and chloro-, esters, action of hexamethylenetetramine on (LOCQUIN), A., i, 589.
 chloro-, action of, on diphenylthiosemicarbazide (v. WALTHER and STENZ), A., i, 569.
 action of, on thioncarbamates and thioncarbanilates (WHEELER and BARNES), A., i, 565.
 methyl ester, action of, on tertiary bases (CENSI), A., i, 363.
 phenyl ester, reactions of (MOREL), A., i, 157, 158.
mono-, *di*- and *tri*-chloro-, dissociation constants of, dissolved in mixtures of organic solvents and water (MORELLO), A., ii, 395.
 action of chloral on (GABUTTI), A., i, 370.
- ciano**-, ethyl ester, action of, on ketones (GUARESCHI and GRANDE), A., i, 111; (MINOZZI), A., i, 407.
 constitution of the sodium derivative of (THORPE), T., 923; P., 1900, 113.
 action of bromine and carbon disulphide on the sodium derivative of (WENZEL), A., i, 536.
 condensation of the sodium derivative of, with ethyl β -isopropylacrylate, and with ethyl α - and β -methylacrylates (HOWLES, THORPE, and UDALL), T., 943; P., 1900, 115.
 iodo- and bromo-derivatives of (THORPE and YOUNG), T., 936; P., 1900, 115.
 esters of, acyl derivatives of, action of, on benzenediazonium and diphenyltetrazonium chlorides (FAVREL), A., i, 532.
- thiocyano**-, action of phenylhydrazines on (HARRIES and KLAMT), A., i, 413.
 derivatives of (FRERICHS and BECKURTS), A., i, 478.
 esters of, formation and boiling points of (WHEELER and BARNES), A., i, 565.
- Acetic acid bacteria** (HENNEBERG), A., ii, 297.
- Acetic anhydride** and sulphuric acid, action of, on quinones (THIELE and WINTER), A., i, 504.

- Acetic anhydride** and sulphuric acid as oxidising agents (THIELE and WINTER), A., i, 500.
- Acetic peroxides**, *mono-* and *tri-chloro-* (VANINO and UHLEFELDER), A., i, 371.
- Aceto-**. See also under Parent Substance.
- Acetoacetic acid**, detection and estimation of, in pathological urine (ARNOLD), A., ii, 768.
- estimation of, in urine (SABBATANI), A., ii, 32.
- Acetoacetic acid**, ethyl ester, constitution of, and action of dry silver oxide and ethyl iodide, and dry silver oxide and ethyl iodoacetate on (LANDER), T., 788; P., 1900, 6, 90.
- influence of the solvent on the constitution of (WISLICIENUS), A., i, 9.
- affinity and hydrolytic constants of (GOLDSCHMIDT and OSLAN), A., i, 132, 373.
- acetylation of (CLAISEN and HAASE), A., i, 373.
- and substituted acetoacetates, action of, on *p*-aminobenzoic acid, in presence or absence of pyridine (TROEGER), A., i, 226.
- condensation of, with *m*-aminophenols (v. PECHMANN; v. PECHMANN and SCHALL), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.
- action of phenylcarbimide on (DIECKMANN), A., i, 482.
- condensations of, with sodium ethoxide, and their reversal (DIECKMANN), A., i, 623.
- menthyl ester (COHN; COHN and TAUSS), A., i, 350.
- Acetoacetic acid**, α -chloro-, ethyl ester, interaction of, with thiosulphonates (TROEGER and EWERS), A., i, 494.
- Acetol**. See Acetylcarbinol.
- 1-Acetonaphthalide**, 2:4-dinitro-, action of tin and of iron on (MELDOLA and EYNON), T., 1159; P., 1900, 166.
- Acetone**, formation of (SABBATANI), A., i, 536.
- heat of combustion and of formation of (BERTHELOT and DELÉPINE), A., ii, 334.
- boiling point of mixtures of, with benzene (HAYWOOD), A., ii, 64.
- vapour pressure relations of mixtures of water and (TAYLOR), A., ii, 529.
- equilibrium between phenol, water, and (SCHREINEMAKERS), A., ii, 393.
- chemical dynamics of the condensation of (KOELICHEN), A., ii, 395.
- action of ammonium cyanide on (v. GULEWITSCH), A., i, 476.
- Acetone**, condensation of, with *iso*-butaldehyde (FRANKE and KOHN), A., i, 206.
- action of Caro's reagent on (v. BAEYER and VILLIGER), A., i, 133, 206, 328.
- methylation of (NEF), A., i, 349.
- action of *iso*amyl nitrite and alcoholic hydrogen chloride on (KISSEL), A., i, 621.
- reactions in water and (ROHLAND), A., ii, 468.
- formation of, in the body (WALD-VOGEL), A., ii, 153.
- testing of (CONROY), A., ii, 374.
- detection of (RIMINI), A., ii, 56.
- detection of, in urine and other secretions (OPPENHEIMER), A., ii, 180.
- estimation of, in urine (SABBATANI), A., ii, 32.
- separation of, from acetoacetic and acetonedicarboxylic acids (SABBATANI), A., ii, 32.
- Acetone**, chloro-, action of, Caro's reagent on (v. BAEYER and VILLIGER), A., i, 329.
- action of, on phenyl-*p*-tolylthiocarbamide (v. WALTHER and STENZ), A., i, 569.
- nitro-, and its phenylhydrazone (LUCAS), A., i, 82.
- Acetonechloroform** (*chlortone*), pharmacology of (ALDRICH and HOUGHTON), A., ii, 353.
- Acetonediamyldisulphone**, amino-, and its salts (POSNER and FAHRENHORST), A., i, 17.
- Acetonedicarboxylic acid**, formation of (DENIGES), A., i, 204; (SABBATANI), A., i, 536.
- oxidation of, in presence of ferrous salts (FENTON and JONES), T., 76; P., 1899, 224.
- mercury salts and derivatives of (LEY), A., i, 382.
- compound of, with mercuric sulphate, and detection of (DENIGES), A., i, 89.
- physiological action of, and estimation of, in urine (SABBATANI), A., ii, 32.
- Acetonedicarboxylic acid**, methyl or ethyl ester, condensation of with benzaldehyde (PETRENKO-KRITSCHENKO and ELTCHANINOFF), A., i, 307.
- ethyl ester, action of ethyl ethoxymethylenecetoacetate and ethoxymethylenemalonate on (ERRERA), A., i, 33.
- trimethyl ester, condensation of, to trimethyl orcinoltricarboxylate (DOOTSON), T., 1196; P., 1900, 170.

- Acetonedicarboxylic acid**, cyano-, ethyl ester, ethyl derivative, and salts of (DERÔME), A., i, 426.
- Acetonediphenyldisulphone**, amino-, and its platinumchloride (POSNER and FAHRENHORST), A., i, 18.
- Acetone glycosuria** (RUSCHHAUPT), A., -ii, 675.
- Acetone peroxide** (v. BAEYER and VILLIGER), A., i, 133, 328.
- Acetonitrile**, action of, on anthranilic acid (BOGERT and GOTTHELF), A., i, 412.
- Acetonuria** (LÜTHJE), A., ii, 229.
- Acetonylacetone**, preparation of (KNORR), A., i, 376.
condensation of, with diethyl oxalate (GRAY), A., i, 376.
- 2-Acetonyl- α -naphthaquinone-3-acetic acid**, ethyl ester of (LIEBERMANN), A., i, 311.
- Acetophenone**, specific heat and heat of vaporisation of (LUGININ), A., ii, 334.
conversion of, into triphenylbenzene (DELACRE), A., i, 603.
bromo-, action of, on piperidine, and on pyridine (SCHMIDT and HARTONG VAN ARK), A., i, 686, 687.
dibromo- and α -dichloro- (WITTORFF), A., i, 422.
- Acetophenoneazobilirubin** (PRÖSCHER), A., i, 571.
- Acetophenonesphenylacetylene** (NEF), A., i, 21.
- Aceto- m -toluidide**, chlorination of (REVERDIN and CRÉPIEUX), A., i, 644.
- Acetotoluidides**, o - and p -, substituted nitrogen chlorides and bromides from (CHATTAWAY and ORTON), T., 789; P., 1900, 102.
- Acetoxime**, spectra of (HARTLEY and DOBBIE), T., 321; P., 1900, 14.
oxidation of (SCHMIDT), A., i, 332.
- p -Acetoxy- ψ -cumyl alcohol**, bromide, and iodide, dibromo- (AUWERS, TRAUN, and WELDE), A., i, 165, 168.
dibromo- p - ψ -cumyl ether, dibromo- (AUWERS, TRAUN, and WELDE), A., i, 169.
- 4-Acetoxy-mesityl bromide**, 2:6-dibromo-, ethers from (AUWERS, TRAUN, and WELDE), A., i, 168.
iodide, 2:6-dibromo- (AUWERS, TRAUN, and WELDE), A., i, 166.
- Acetoxymesityl oxide** (*methyl acetoxymesityl ketone*) (PAULY and LIECK), A., i, 275.
- Acetoxynaphthalic anhydride** and derivatives (ANSELM and ZUCKMAYER), A., i, 175.
- 5-Acetoxy-1-phenyltriazole** (RUPE and LABHARDT), A., i, 259.
- Acetyl-**. See also under Parent Substance.
- Acetyl- p -acetaminobenzoic acid**, and chloro- (TROEGER), A., i, 226.
- Acetylacetanilide**, **Acetylaceto- ψ -cumidide**, and **Acetylaceto- m - and - p -toluidides**, and **Acetyl- α -aceto- m -xylylidide chloro-** (KUNCKELL), A., i, 663.
- Acetylacetone**, action of ethyl mercaptan on (LLAGUER), A., i, 504.
new metallic salts of (GACH), A., i, 276.
- Acetylaconitic acid**, ethyl ester (RUHEMANN and STAPLETON), T., 804; P., 1900, 121.
- o -Acetylaminooacetophenone**, action of aqueous soda on (CAMPS), A., i, 115.
- 7-Acetyl-amino-4-anilino- β -naphthaquinone** (KEHRMANN and WOLFF), A., i, 449.
- 4- p -Acetylaminobenzeneazo-1-phenyl-3-methylpyrazolone** (BÜLOW), A., i, 261.
- Acetyl-amino-benzoic** and -**cinnamic acids**, chloro- m - and - p -, methyl esters (EINHORN and OPPENHEIMER), A., i, 493.
- p -Acetylaminobenzoylecarbinol** and its phenylhydrazone (KUNCKELL), A., i, 663.
- Acetyl-amino- m - and - p -hydroxybenzoic acids**, 4- and 3-chloro-, methyl esters (EINHORN and OPPENHEIMER), A., i, 493.
- Acetylaminomethylphenonaphthacridine** ("*acetylaminomethylnaphthacridine*"), methylation of, and its methyl sulphate (ULLMANN and NAERF), A., i, 689.
- 9-Acetylaminonaphthaphenasine** (KEHRMANN and WOLFF), A., i, 450.
- 7-Acetyl-amino- β -naphthaquinone** (KEHRMANN and WOLFF), A., i, 449, 463.
- 7-Acetyl-amino-2-naphthol** and its 1-amino-derivative (KEHRMANN and WOLFF), A., 449.
- α - p -Acetylaminophenylazoacetoacetic acid**, its ethyl ester and amides (BÜLOW), A., i, 261.
- 2-Acetyl-amino-7-phenylnaphthaphenazonium 7-bromide** (KEHRMANN and WOLFF), A., i, 464.
- 2-Acetyl-amino-12-phenylisonaphthaphenazonium salts** (KEHRMANN and WOLFF), A., i, 463.
- Acetylaminosalicylic acid**, 5- and 3-, chloro-, methyl esters (EINHORN and OPPENHEIMER), A., i, 493.
- 1- o - and - p -Acetyl-amino- p - and - o -tolyl-2:5-dimethylpyrrole-3:4-dicarboxylic acid**, ethyl esters (BÜLOW), A., i, 690.

- Acetylaniline**, *p*-chloro- (KUNCKELL), A., i, 663.
- Acetyl-anthranil**, formation of (BREDT and HOF), A., i, 229.
- Acetyl-anthranilic acid** (ERDMANN), A., i, 189.
- chloro-, methyl ester (EINHORN and OPPENHEIMER), A., i, 493.
- Acetylation** in presence of pyridine (MINUNNI), A., i, 214.
- with acetic anhydride in aqueous solution (PINNOW), A., i, 214.
- of primary and secondary amines (MUSSELIUS), A., i, 334.
- Acetylbenzoyl-*t*-diphenylethylenediamine** (JAPP and MOIR), T., 612; P., 1899, 211.
- β*-Acetylisobutyric acid**, mercury salts and derivatives of (LEY), A., i, 382.
- Acetylcarbamide**, cyano- (TRAUBE), A., i, 416.
- Acetylcarbinol** (*acetol*) from propylene glycol (KLING), A., i, 129.
- its condensation product, phenylhydrazone, -osazone, and semicarbazone (PERATONER and LEONARDI), A., i, 551.
- Acetyl-chloro- and -bromo-aminobenzenes** (*phenyl acetyl nitrogen chlorides and bromides*), and their chloro- and bromo-derivatives, transformation of (CHATTAWAY and ORTON), T., 798; P., 1900, 112.
- Acetylchloroamino-mono-, -di-, and -trichlorobenzenes** (*chlorophenyl acetyl nitrogen chlorides*) (CHATTAWAY, ORTON, and HURLEY), T., 800; P., 1900, 125.
- Acetyl-chloro- and -bromo-aminotoluenes**, *o*- and *p*- (*o*- and *p*-*tolyl acetyl nitrogen chlorides and bromides*) and their chloro- and bromo-derivatives (CHATTAWAY and ORTON), T., 790; P., 1900, 102.
- Acetylchloromorphide** (SCHRYVER and LEES), T., 1024; P., 1900, 143.
- 1-Acetylcoumarone** and its bromide, and 4-bromo- and 4-chloro-, and their oximes (STOERMER), A., i, 655.
- Acetyl- ψ -cumidine**, chloro-, and chloro-nitro- (KUNCKELL), A., i, 664.
- γ -Acetyl- β -diethylacetoacetic acid**, ethyl ester (DIECKMANN), A., i, 624.
- 1-Acetyl-4:4-dimethyldihydrodithiazine**, 2:6-dicyano- (HELLSING), A., i, 518.
- Acetyldiphenylamide**, and its sulphonic acid, α -*di-p*-nitro- (GNEHM and WERDENBERG), A., i, 93.
- Acetylene**, generation and purification of, (MATHEWS), A., i, 323.
- purification of (ULLMANN and GOLDBERG), A., i, 1.
- Acetylene**, disadvantage of using sawdust in the purification of (AHRENS), A., i, 1.
- products of the explosion of (MIXTER), A., i, 197.
- and mixtures of acetylene and nitrogen, products of the explosion of (MIXTER), A., i, 618.
- action of anhydrous aluminium chloride on (BAUD), A., i, 369.
- action of copper on (SABATIER and SENDERENS), A., i, 197.
- action of cuprous chloride dissolved in potassium chloride solution on (CHAVASTELON), A., i, 470.
- action of, on copper oxides and on silver oxide (GOOCH and BALDWIN), A., i, 74.
- hydrogenation of, in presence of copper (SABATIER and SENDERENS), A., i, 421.
- action of reduced nickel on (SABATIER and SENDERENS), A., i, 471.
- action of finely divided platinum, cobalt, and iron on (SABATIER and SENDERENS), A., i, 534.
- hydrogenation of, in presence of reduced iron or cobalt, or finely divided platinum (SABATIER and SENDERENS), A., i, 470, 471.
- action of hypochlorous and hypobromous acids on (WITTOEFF), A., i, 421.
- oxidation of (BASCHIERI), A., i, 534.
- action of hydrogen peroxide on (CROSS, BEVAN, and HEIBERG), A., i, 534.
- as a laboratory fuel (LACHMAN), A., ii, 593.
- compounds of, with cuprous and potassium chlorides (CHAVASTELON), A., i, 470.
- detection of, by ammoniacal copper solutions and hydroxylamine (ILOSVAY DE NAGY ILOVA), A., ii, 52.
- Acetylene purifiers**, estimation of chromic acid in (ULLMANN and GOLDBERG), A., i, 1.
- Acetylenedicarboxylic acid**, oxidation of, in presence of ferrous salts (FENTON and JONES), T., 76; P., 1899, 224.
- Acetylenedicarboxylic acid**, ethyl ester, preparation of (RUHMANN and BEDDOW), T., 1121.
- condensation of, with β -ketonic esters and with benzamidine and with guanidine (RUHMANN and STAPLETON), T., 804; P., 1900, 121.
- action of phenols on (RUHMANN and BEDDOW), T., 1119; P., 1900, 165.

- Acetylenedicarboxylic acid**, ethyl ester, condensation of, with phenyl mercaptan (RUHEMANN and STAPLETON), T., 1181; P., 1900, 168.
- Acetylguanidine**, cyano- (TRAUBE), A., i, 416.
- 3-Acetyl-4-hydroxyisocarbostyryl** and its isomeride (GABRIEL and COLMAN), A., i, 689.
- Acetylmalonanilic acid**, ethyl ester, formation of (DIECKMANN), A., i, 482.
- Acetylmethylcyclohexanone** and a ketonic acid from (LESER), A., i, 430.
- Acetylmethylhexoic acid** (LESER), A., i, 430.
- Acetylmethylnaphthindenequinone-carboxylic acid**, ethyl ester (MICHEL), A., i, 670.
- Acetylmethylnitrolic acid**, isomeric compounds, $C_6H_5O_4N_4$, from (STEFFENS), A., i, 74.
- β -Acetylisoo- β -pentene- $\alpha\alpha$ -dicarboxylic acid**, ethyl ester (*ethyl mesityl-oxide-malonate*) (PAULY and LIECK), A., i, 275.
- Acetylphenylthiocarbamide** and its isomeride (HUGERSHOFF), A., i, 156.
- Acetylphenylacetylene** and its diiodide (NEF), A., i, 21.
action of potash on (MOUREU and DELANGE), A., i, 397.
- Acetylphenylglycine- α -carboxylic acid** and its diethyl ester (VORLÄNDER and WEISSBRENNER), A., i, 295.
- Acetylphenylhydrazonedi- p -tolylguanidine** (SCHALL), A., i, 464.
- Acetylphenylthiocarbamide**, and its isomeride (HUGERSHOFF), A., i, 156.
action of phenylhydrazine on, (WHEELER and SANDERS), A., i, 564.
- Acetylphenylurethane** and the action of phenylhydrazine on (WHEELER and SANDERS), A., i, 564.
- β -Acetylpropionic acid**. See Lævulic acid.
- α -Acetylpropionitrile**, and α -chloro- (HENRY), A., i, 538.
- Acetylpropionylsalicylic acid osazone** (AUDEN), P., 1899, 231.
- Acetylpyrrolidone** (TAFEL and STERN), A., i, 557.
- Acetyl tartaric acid**, diethyl ester, rotation of (McCRAE and PATTERSON), T., 1096; P., 1900, 161.
- Acetylthiocarbimide**, reactions of, with imino-ethers (WHEELER and SANDERS), A., i, 563.
- Acetyl- α -, - m -, and - p -toluidine**, chloro- (KUNCKELL), A., i, 663.
- Acetyl- α - and - p -tolylthiocarbamides** and their isomerides (HUGERSHOFF), A., i, 156.
- 5-Acetyl-1:2:3-triazole** and its 4-carboxylic acid, trichloro- (ZINCKE, STOFFEL, and PETERMANN), A., i, 526.
- Acetyl- α - m -xylidine**, chloro- and chloronitro- (KUNCKELL), A., i, 664.
- Acetylxyldinesulphonic acids** (JUNGHANN), A., i, 389.
- Acetylxylononitrile** (MAQUENNE), A., i, 423, 472.
- Achroodextrin III**, preparation and properties of (PRIOR and WIEGMANN), A., i, 541.
- Acid** (m. p. 115°) from benzyl cyanide and ethyl fumarate (HENZE), A., i, 347.
(m. p. 279-280°) from the oxidation of ricinine (EVANS), A., i, 309.
- $C_4H_4O_3$, from β -bromoglutaric acid (SSEMENOFF), A., i, 10.
- $C_4H_4O_3$, from β -hydroxyglutaric acid (FICHTER and KRAFFT), A., i, 8.
- $C_6H_3O_3N_3Cl_2$, from the action of sodium hydroxide on azimino*tetra*-chloroketodihydrobenzene (ZINCKE, STOFFEL, and PETERMANN), A., i, 527.
- $C_7H_{10}O_6$, from the oxidation of isopilocarpine with permanganate (JOWETT), T., 852; P., 1900, 124.
- $C_7H_{12}O_2$, from methylcyclohexanone-oxime and from suberoneisoxime (WALLACH), A., i, 45.
- $C_8H_{10}O_2$, from the action of potassium hydroxide on the methylammonium hydroxide of *cis*-hexahydro- p -diethylbenzylaminecarboxylic acid (EINHORN and PAPASTAVROS), A., i, 228.
- $C_8H_{12}O_4$, and $C_9H_{14}O_3$, from verbenone (KERSCHBAUM), A., i, 353.
- $C_9H_{14}O_3$, from the action of sodium and amyl alcohol on phenylaminoacetic acid (EINHORN and PREIFFER), A., i, 222.
- $C_8H_{14}O_3$, and $C_{10}H_{16}O_4$ (or O_5), from isobutyl nitrite, alcohol, and hydrogen chloride (KISSEL), A., i, 621.
- $C_9H_{12}O_4$, and $C_{11}H_{18}O_4$, from cyclopentanone and ethyl succinate (STOBBE and FISCHER), A., i, 179.
- $C_9H_{14}O_2$ (two), from the hydrolysis of methyl bromodihydro- ψ -lauronolate (LEES and PERKIN), P., 1900, 19.
- $C_9H_{14}O_2$, $C_9H_{16}O_2$, and $C_9H_{10}O_2$, from camphoric anhydride and aluminium chloride (BLANC), A., i, 134.
- $C_9H_{14}O_4$, from the reduction of β -hydroxy- γ -tetramethylglutaric acid (MICHAILENKO and JAVORSKY), A., i, 586.

- Acid**, $C_9H_{14}O_6$, from the oxidation of *iso*-lauronic acid (BLANC), A., i, 329.
- $C_9H_{13}BrO_2$ (two), from the action of hydrogen bromide in glacial acetic acid on ψ -campholactone (LEES and PERKIN), P., 1900, 18.
- $C_9H_{16}O_3$ (two), from the action of alkalis on ψ -campholactone (LEES and PERKIN), P., 1900, 18.
- $C_{10}H_9O_5N$, from permanganate and chloroacetyl-*o*-toluidine (KUNCKELL), A., i, 664.
- $C_{10}H_{10}O_8$, from the oxidation of *iso*-safrole (BOUGAULT), A., i, 495.
- $C_{10}H_{12}O_3$, from the aldehyde $C_{10}H_{12}O_2$, from the oxidation of anethole (BOUGAULT), A., i, 495.
- $C_{10}H_{16}O_4$, from α -dibromocamphor and nitric acid (LAPWORTH and CHAPMAN), T., 310; P., 1900, 4.
- $C_{10}H_{16}O_8$, and $C_{10}H_{14}O_8$, from the oxidation of dihydrocampholenic acid (MAHLA and TIEMANN), A., i, 507.
- $C_{11}H_{12}O_7$, $C_{20}H_{20}O_8$, and $C_{20}H_{20}O_{10}$, from the oxidation of tetramethylhematoxylin (PERKIN and YATES), P., 1900, 108.
- $C_{11}H_{16}O_4$, and $C_{11}H_{18}O_5$, from the action of hydrogen cyanide and hydrochloric acid on camphonic acid (LAPWORTH and CHAPMAN), T., 450; P., 1900, 56.
- $C_{11}H_{20}O_4$, from the oxidation of undecenoic acid (THOMS), A., i, 622.
- $C_{12}H_{12}O_8$, and $C_{12}H_{14}O_9$, from the oxidation of trimethylbrazilin (GILBODY, PERKIN, and YATES), P., 1900, 106.
- $C_{12}H_{14}O_8$, from the oxidation of *iso*-apiole (BOUGAULT), A., i, 495.
- $C_{13}H_{18}O_9$, from methylenebisdihydroresorcinol and caustic alkali (VORLÄNDER and KALKOW), A., i, 99.
- $C_{14}H_{14}O_4$, from the oxidation of *iso*-methyleugenol (BOUGAULT), A., i, 495.
- $C_{14}H_{16}O_8$, and $C_{20}H_{26}O_8$, from oil of savin (FROMM), A., i, 402.
- $C_{15}H_{24}O_8$, and $C_{15}H_{24}O_9$, from the fusion of dihydroxystearic acid with potash (LE SUEUR), P., 1900, 91.
- $C_{21}H_{26}O_{12}$, from ethyl cetipate and hydrogen cyanide (THOMAS-MAMERT and WEIL), A., i, 427.
- $C_{22}H_{26}O_9$, from the hydrogen chloride additive product of benzylidenedibenzyl ketone (GOLDSCHMIEDT and KNÖFFER), A., i, 35.
- $C_{24}H_{22}O_6N_2$, or $C_{24}H_{22}O_5N_3$, from benzoylusnic acid (PATERNO), A., i, 662.
- Acid**, $C_{21}H_{24}O_4$, from the bromo-derivative of 2:5-diphenylethylenetetrahydropyrone-3-carboxylic acid (COEN), A., i, 308.
- Acid amides**, formation and stability of (MEYER and v. LUTZAU), A., i, 643. structure of (MENSCHUTKIN), A., i, 337. determination of the constitution of, cryoscopically (AUWERS and DOHEN), A., ii, 134.
- Acid chloride**, conversion of an, into an anhydride, by the action of haloid acids (VANDEVELDE), A., i, 272.
- Acidimetry** (ASTRUC), A., ii, 572. of organic basic acids (ASTRUC), A., i, 199; ii, 508; (IMBERT and ASTRUC), A., i, 226. of cacodylic acid (IMBERT), A., i, 145. of substituted malonic acids compared with that of corresponding normal dibasic acids (MASSOL), A., i, 200.
- Acids**, thermal value of the acidity of (DE FORCRAND), A., ii, 527, 528. velocity of reaction of, in organic solvents (GEIGER), A., ii, 394. relation of the taste of, to their degree of dissociation (KAHLENBERG), A., ii, 270, 646; (RICHARDS), A., ii, 391. action of, on nitrogen iodide (CHATTAWAY and STEVENS), A., ii, 722. toxic action of, on *Lupinus albus* (TRUE), A., ii, 303; (KAHLENBERG and AUSTIN), A., ii, 747. standardising (SEYDA), A., ii, 44; (THIELE and RICHTER), A., ii, 620. precautions necessary in using phenolphthalein as an indicator in titrating (MAGNIER DE LA SOURCE), A., ii, 620. separation and identification of (AREGG and HERZ), A., ii, 436; (FRESSENIUS), A., ii, 754. from ethyl cyanoacetate, method of separating the *cis*- and *trans*-modifications of (THORPE), T., 934; P., 1900, 114.
- Acids**, acyclic and cyclic, mixed anhydrides of (BÉHAL), A., i, 8.
- Acids**, fatty, determination of the constitution of (CROSSLEY and LE SUEUR), T., 83; P., 1899, 225. determination of the solidifying point of (FREUNDLICH), A., ii, 250. iodation of (ZERNOFF), A., i, 327. dibasic, heat of neutralisation of, compared with that of substituted malonic acids (MASSOL), A., i, 200. containing isopropyl, action of nitric acid on (BREDT and KERSHAW), A., i, 136.

- Acids, fatty**, dibasic, action of phenyl-carbimide and -thiocarbimide on (BÉNECH), A., i, 340.
 oxidation of, by acid potassium permanganate (PERRIX), A., i, 582.
 identification of (AUWERS), A., i, 84.
 saturated, constitution of (KOMPPA), A., i, 201.
 dissociation constants of (WALKER), T., 397.
 substituted (VANDEVELDE), A., i, 272.
 unsaturated, preparation of, by boiling dibasic β -hydroxy-acids with aqueous sodium hydroxide (FICHTER and DREYFUS), A., i, 426.
 free, estimation of, volumetrically (SWOBODA), A., ii, 514.
 halogenated, action of water on (DE BARR), A., i, 76.
 lower, estimation and separation of (SCHÜTZ), A., ii, 250.
 saturated, affinity coefficients of (BILLITZER), A., i, 7.
 unsaturated, from mercaptols and disulphones of ketonic acids (POSNER), A., i, 5.
 action of hypobromous and hypochlorous acids on (MELIKOFF), A., i, 536.
 estimation of, in fish oils (BULL), A., ii, 250, 325.
 volatile, in beer (SPAETH), A., ii, 177.
 origin of, in butter (ZUNTZ and USSOW), A., ii, 669.
 estimation of, in butter by the Leffmann-Beam's glycerol-soda process (SEYDA), A., ii, 772.
- Acids, inorganic**, complex (KEHRMANN and RÜTTIMANN), A., ii, 145.
 weak, hydrolysis of the sodium salts of, in relation to their dissociation constants (WALKER), A., ii, 268.
 very weak, dissociation constants of (WALKER and CORMACK), T., 5; P., 1899, 208.
- Acids, organic**, isolation and separation of (SCHOORL), A., ii, 449.
 electrolysis of the alkali salts of (PETERSEN), A., ii, 522.
 acidimetry of (ASTRUC), A., i, 199; ii, 508; (IMBERT and ASTRUC), A., i, 226.
 oxidation of, in presence of ferrous salts (FENTON and JONES), T., 69; P., 1899, 224.
- Acids of the oxalic acid series**, derivatives and physical properties of (MEERBURG), A., i, 144.
- Acids of the sugar group**, formation of, and their methylene derivatives (CLOWES and TOLLENS), A., i, 205.
- Acids, unsaturated**, coloured, dibasic, transformation of, into colourless stereoisomerides (STOBBER), A., i, 659.
- Acids, weak**, characterisation of (HANTZSCH), A., i, 94.
 change in the strength of, by the addition of salts (ARRHENIUS), A., ii, 201.
- Acids. See also Pseudo-acids.**
Acids (or their salts or derivatives). See also :—
 Abienic acid.
 Abietinic acid.
 Abietolic acid.
 Acetic acid.
 Acetoacetic acid.
 Acetonedicarboxylic acid.
 Acetonyl- α -naphthaquinone-3-acetic acid.
 Acetyl-*p*-acetaminobenzoic acid.
 Acetylaconitic acid.
 Acetylaminobenzoic acids.
 Acetylaminocinnamic acids.
 Acetylaminohydroxybenzoic acids.
 Acetylaminophenylazoacetoacetic acid.
 Acetylaminosalicylic acid.
 Acetylaminotolyl-2 : 5-dimethylpyrrole-3 : 4-dicarboxylic acid.
 Acetylanthranilic acid.
 β -Acetylisobutyric acid.
 α -Acetyl- β -diethylacetoacetic acid.
 Acetyldiphenylamidesulphonic acid.
 Acetylenedicarboxylic acid.
 Acetylmalonanilic acid.
 Acetylmethylhexoic acid.
 Acetylmethylnaphthindenequinone-carboxylic acid.
 Acetylmethylnitrolic acid.
 β -Acetyliso- β -pentene- $\alpha\alpha$ -dicarboxylic acid.
 Acetylphenylglycine-*o*-carboxylic acid.
 Acetyltartaric acid.
 5-Acetyl-1 : 2 : 3-triazole-4-carboxylic acid.
 Acetylxylidinesulphonic acids.
 Acrylic acid.
n-Adipic acid.
 Aldehydo-*o*-aminobenzoic acid.
 Aldehydophenoxyacetic acid.
 Allylmalonic acids.
 isoAmylcitraconic acid.
 isoAmylsuccinic acid.
 Amylxanthic acid.
 Anhydrobis-5-methoxy-7-methyl-diketohydrindene-4-carboxylic acid.
 β -Anhydrohomocamphoronic acid.
 Anhydromalic acid.
 Anhydro- α -naphthaquinone-2-acetone-dicarboxylic acid.

Acids. See:—

Anhydrocispentamethylenetricarboxylic acid.
 Aniliminocarbaminothioglycollic acid.
 Anilinoacetic acid.
 Anilinoembelic acid.
 Anilinomalonic acid.
 Anilinophenylglycine-*o*-carboxylic acid.
 Anisylanthranilic acid.
 Anthranilic acid.
 Anthranilphenylacetic acid.
 9-Anthranol-2-carboxylic acid.
 Anthraquinone-2-carboxylic acid.
 Antipyrine-1-*p*-benzoic acid.
 Arabic acid.
 Asparagine.
 Azelaic acid.
 Aziminoethylenedicarboxylic acid.
 Aziminoethylenedicarboxylic acid.
 Azobenzene-4 : 3' : 5' : trisulphonic acid.
 Barbituric acid.
 Benzeneazodiacetylsuccinic acid.
 Benzeneazo- β -naphthylcarbamic acid.
 Benzenecyanonitroic acid.
 Benzenediazonium-*o*-sulphonic acid.
 Benzenedimetaphosphoric acids.
 Benzene-*o*-disulphonic acid.
 Benzenestearosulphonic acid.
r- α -Benzenesulphaminobutyric acid.
 Benzenesulphonic acid.
 1 : 2 : 3 : 4-Benzene-tetracarboxylic acid.
pp-Benzhydrol-dicarboxylic acid.
 Benzhydroxamic acid.
 Benzoic acid.
 Benzonitroic acid.
 Benzophenonedicarboxylic acids.
 Benzophenonediphenyldiketonedicarboxylic acid.
 Benzo- γ -pyroncarboxylic acid.
 Benzoyl-lactic acids.
 Benzoyl-lactic acid.
 Benzoyl- α -aminobutyric acids.
p-Benzoylanilinocinnamylformic acid.
 Benzoylanthranilic acid.
 Benzoyl-*l*-aspartic acid.
o-Benzoylbenzenesulphonic acid.
 Benzoylbenzoic acids.
 Benzoylcarbaminothioglycollic acid.
 Benzoylglutamic acid.
 Benzoyliminothiocarbonic acid.
 Benzoylleucine.
 β -Benzoyl- α -methylpropionic acid.
 4-Benzoylnicotinic acid.
 Benzoylphenetidinesulphonic acid.
 Benzoyl-*d*-phenylalanine.
s-Benzoylphenylhydrazine-*p*-sulphonic acid.
 Benzoylphenyloxamic acid.
 β -Benzoylpropionic acid.
 Benzoyltyrosine.

Acids. See:—

Benzoyluric acid.
 Benzylanilinosulphonic acids.
 Benzylformhydroxamic acid.
 Benzylidenebisacetonedicarboxylic acid.
 Benzylidenecampholic acid.
 Benzylsulphide-*p*-dicarboxylic acid.
 β -Benzylsulphoneallylphthalamic acid.
 Bisdiazoacetic acid.
 Butanedicarboxylic acids.
*cyclo*Butanedicarboxylic acid.
 Butanetetra-carboxylic acid.
sec-.Butylbenzene-*p*-sulphonic acid.
 Butylenedicarboxylic acid.
 5-Butylisophthalic acid.
 Butyltoluic acids.
 Butyric acids.
*iso*Butyrylacetic acid.
 Butyrylacetosacetic acids.
 Cacodylic acid.
 Camphenilanic acid.
 Campholic acid.
 Campholytic acid.
 Camphonic acid.
 Camphononic acid.
 Camphopyric acid.
 Camphorenic acid.
 Camphoric acids.
l-*iso*Camphoric acid.
 Camphoronic acid.
*iso*Camphoronic acid.
 Camphoroxalic acid.
 Camphoroximeacetic acid.
 Canadic acid.
 Canadinolic acid.
 Canadolic acid.
 Carbaminothioglycollic acid.
 Carbanilol-*iso*butyric acid.
 Carbethoxythiocarbamic acid.
 Carbiminothioglycollic acid.
 Carbonylhydroferrocyanic acid.
 α -Carboxyphenoxybutyric acids.
 α -Carboxyphenoxypropionic acid.
 α -Carboxyphenoxyisovaleric acid.
o-Carboxyphenylglycollic acid.
 Carminic acid.
 Carpic acid.
 α -Carvacroxybutyric acids.
 α -Carvacroxypropionic acid.
 α -Carvacroxyisovaleric acid.
 Carvonedihydrodisulphonic acid.
 Cascarillic acid.
 Catechobis- α -oxybutyric acids.
 Catechobis- α -oxypropionic acid.
 Catechobis- α -oxyisovaleric acid.
 Catecholacetic acid.
 Cetipic acid (*oxal-diacetic acid*).
 Chrysænic acids.
 Chrysoidinesulphonic acid.
 Chrysoketonecarboxylic acid.
 Chrysophanic acid.

Acids. See:—

Cinchomeronic acid.
Cinenic acid.
Cineolic acid.
Cinnamhydroxamic acid.
Cinnamic acids.
Cinnamylidenacetic acids.
δ-Citralidenecyanoacetic acid.
Citrapyrotartaric acid (*methylsuccinic acid*).
Citrazinic acid.
Citric acid.
Cochinelic acid.
Comenic acid.
Coumarilic acid.
Coumaroxycetic acid.
Crotonic acid.
α-ψ-Cumenoxypionic acid.
Cuminuric acid.
isoCyanic acid.
Decanedicarboxylic acid.
Decarboxyδ-bromocarminic acid.
Decarbusnic acid.
Decenoic acids.
Decoic acids.
Dehydracetic acid.
Dehydrocamphoric acid.
Diacetylamino phenolsulphonic acid.
Diacetylanthranilic acid.
Diacetylpropionic acid.
Diacetylpyrotarabic acid.
Diacetyl tartaric acid.
Diamyldisulphoneacetonephthalamic acid.
Dianilino-orthophosphoric acid.
Diaspartidodiaspartic acid.
Diazoacetic acid.
Diazoaminobenzenedi-*p*-sulphonic acid.
Diazoazobenzenetrisulphonic acid.
Diazobenzene-*m*-hydrazinobenzoic acid.
Diazobenzene piperidesulphonic acid.
Diazobenzene-*o*-sulphonic acid.
Diazobenzoic acid.
Diazolone-1-propionic acid.
Diasosalicylic acid.
Diazotetronosulphonic acid.
Dibenzoylsuccinic acid.
Dibenzoyltyrosine.
Dibenzylacetoacetic acid.
Dibenzylcyanoacetic acid.
Dibenzylidenesuccinic acid.
Dibenzylmalonic acid.
s-Diisobutylsuccinic acids.
Di-*p*-carboxybenzylacetic acid.
2:6-Dicarboxyphenol.
Dicranumtannic acid.
β-Diethothiobutyric acid.
β-Diethothio-α-ethylbutyric acid.
β-Diethothioglutaric acid.
β-Diethothio-α-methylbutyric acid.
β-Diethoxypropionic acid.
Diethoxysuccinic acid.

Acids. See:—

2'-Diethylaminobenzoylbenzoic acid.
2'-Diethylaminobenzylbenzoic acid.
p-Diethylaminophenylacetic acid.
β-Diethylidissulphoneglutaric acid.
α-Diethylidissulphonepropionic acid.
α-Diethylidissulphonevaleric acid.
Diethyluric acid.
Dihydroanthracene-2-carboxylic acid.
Dihydrocampholenic acid.
Dihydrocampholytic acid.
Dihydrocinnamhydroxamic acid.
Dihydroiselaunonic acid.
Dihydropyrazine-2:3-diacetic acid.
Dihydropyridinedicarboxylic acids.
Dihydrotetrazinedicarboxylic acid.
Dihydroxamic acid. |
2-*mp*-Dihydroxybenzylidene-5-methoxy-7-methyl-1:3-diketohydrindene-4-carboxylic acid.
Dihydroxybutanetetra-carboxylic acid.
Dihydroxydiphenylmethane-2:4'-dicarboxylic acid.
Dihydroxynaphthalenecarboxylic acids.
2:6-Dihydroxypyridine-3:4-dicarboxylic acid.
Dihydroxystearic acid.
Dihydroxytrimelic acid.
Diindonesacetic acid.
Diindonecyanoacetic acid.
3:5-Dimethoxybenzoic acid.
Dimethoxyphenanthrene-9-carboxylic acids.
Dimethylacetoacetic acid.
Dimethylallylmalonic acid.
2'-Dimethylaminobenzoylbenzoic acid.
2'-Dimethylaminobenzylbenzoic acid.
6-Dimethylamino-3-methylcoumarilic acid.
αα-Dimethyl-α-isoamylsuccinic acid.
o-Dimethyl-*o*-benzylbenzoic acid.
Dimethylbutanetricarboxylic acid.
αα-Dimethyl-α-isobutylsuccinic acid.
α-Dimethylisocrotonic acid (2-di-methyl-3-butinoic acid).
Dimethyldihydropyridinedicarboxylic acid.
Dimethylenegalactonic acid.
Dimethylenexylic acid.
αα-Dimethyl-α-ethylsuccinic acid.
Dimethylfumaric acid.
Dimethylglutaconic acid.
Dimethylglutaric acids.
Dimethylglutolactonic acids.
Dimethylcyclohexanecarboxylic acid.
γδ-Dimethyl-β-hexenoic acid.
αα-Dimethyl-α-propylsuccinic acids.
2:6-Dimethylpyridine-3:5-dicarboxylic acid.
2:6-Dimethylpyridyl-4-sulphonic acid.
Dimethylpyronedicarboxylic acid.

Acids. See:—

as-Dimethylsuccinic acid.
aa-Dimethyltricarballic acid.
 Diphenacetyl tartaric acid.
 Di-*p*-phenetidinophosphoric acid.
as-Diphenoxysuccinic acid.
 Diphenylaminosulphonic acids.
 γ -Diphenyl- α -benzylideneitaconic acid.
 Diphenyldiethylenetetrahydropyrone-3-carboxylic acid.
 2:5-Diphenylethylenetetrahydropyrone-3-carboxylic acid.
 Diphenylmethane-*p*-carboxylic acid.
 Diphenylmethanedicarboxylic acid.
 Diphenylsuccinic acid.
 Diphenyltetrahydropyronedicarboxylic acid.
 Diphthalyllic acid.
 Dipropylsuccinic acids.
 5-Dipyrazylethanedicarboxylic acid.
 Duryluric acid.
 Elaidic acid.
 Ellagic acid.
 Embelic acid.
d-Erythronic acid.
 Ethanedicarboxylic acids.
 β -Ethothioisocrotonic acid.
 β -Ethothio- α -ethylisocrotonic acid.
 β -Ethothioglutaconic acid.
 β -Ethothio- α -methylisocrotonic acid.
 α -Ethoxy- γ -amylxyisovaleric acid.
 β -Ethoxy- β -benzylacrylic acid.
 Ethoxycaronic acid.
 4-Ethoxy-2-methyltrimelic acid.
 β -Ethoxy- β -phenylacrylic acid.
p-Ethoxyphenylurethanesulphonic acid.
 Ethylacetoacetic acid.
 Ethylenebisphenylcarbazinic acid.
 Ethylenedicarboxylic acids.
 Ethyleneketotriazolecarboxylic acid.
 Ethylene-1:2:3-triazolecarboxylic acid.
 Ethylnaphthindolinonequinone-3-carboxylic acid.
 Ethylisopropylacetic acid (*heptioic acid*).
 Ethylisopropylmalonic acid.
 β -Ethylsulphonoglutaconic acid.
 Ethyl- ψ -uric acid.
 Fencholenic acid.
 Filicic acid.
 Flavaspidic acid.
 Fluorenoxalic acid.
 Formazylbenzenesulphonic acids.
 Formhydroxamic acid.
 Formic acid.
 Formylphenylacetic acid.
 Fulminic acid.
 Fumaric acid.
 Furfuroylacetic acid.
 Furfurylacrylic acid.
 Furfurylcarbonylsuccinic acid.
 Furfuryl- α -cyanoacrylic acid.

Acids. See:—

γ -Furfurylpropane- $\alpha\beta\beta$ -tricarboxylic acid.
 Furfurylpropionic acid.
 Furfurylsuccinamic acid.
 Furfurylsuccinic acid.
 Gallic acid.
*iso*Geranic acid.
 Glauconic acids.
 Gluconic acid.
 Glutamic acid.
 Glutaric acid.
 Glyceric acid.
 Glycerophosphoric acids.
 Glycocholic acid.
 Glycocine.
 Glycollic acid.
 Glycolglycollic acid.
 Glycuronic acid.
 Glyoxylic acid.
 Guaiacolcarboxylic acid.
 α -Guaiacoxybutyric acids.
 α -Guaiacoxymalonic acid.
 α -Guaiacoxypropionic acid.
 α -Guaiacoxyisovaleric acid.
 Gulonic acid.
 Hæmatic acid.
 Hemipinic acid.
 Heptanedicarboxylic acid.
*cyclo*Heptatrienecarboxylic acids (*isophenylacetic acids*).
*cyclo*Heptenecarboxylic acids.
 Heptenoic acids.
 Heptoic acids.
 Hexahydro-*p*-benzylaminocarboxylic acids.
 Hexahydro-*p*-diethylbenzylaminocarboxylic acids.
 Hexahydromellitic acid.
trans-Hexahydrophthalic acid.
 Hexahydroxylic acid.
 Hexanedicarboxylic acids.
 $\delta\epsilon$ -Hexenic acid.
 Hexenoic acids.
 Hexoic acid.
*iso*Hexoic acid (*α -methylvaleric acid*).
 Hippuric acid.
 Homocamphanic acid.
 α -Homocamphoramic acid.
 Homocamphoric acid.
 Homocamphoronc acid.
 Homoapocinchonic acid.
 Hydrazinosalicylic acid.
 Hydrazoic acid (*azoinide*).
 Hydrindenesulphonic acid.
 Hydro-*p*-coumaric acid.
 Hydrocyanic acid.
 Hydroembelic acid.
 Hydroferrocyanic acid.
 Hydroxamic acids.
 Hydroxyacetyl-*p*-acetaminobenzoic acid.

Acids. See :—

- 3-Hydroxy-5-alkyl-1:2:4-triazole-1-propionic acids.
- 3-Hydroxy-*i*-amylaminobenzoic acids.
- Hydroxybenzenesazodiphenylaminesulphonic acid.
- Hydroxybenzoic acids.
- 2-Hydroxy-1-benzyl- α -naphthindole-quinonecarboxylic acid.
- Hydroxybutyric acids.
- Hydroxycamphenilanic acid.
- α -Hydroxycamphopyric acid.
- 4-Hydroxyisocarboesteryl-8-carboxylic acid.
- 3-Hydroxy-2:6-dicarboxy-1:4-pyronic acid.
- α -Hydroxy- $\alpha\epsilon$ -dimethylheptoic acid (*α -hydroxy- α -methylisohexylacetic acid*).
- ϵ -Hydroxy- $\beta\zeta$ -dimethylctoic acid.
- Hydroxyethanesulphonic acid.
- Hydroxyethoxynaphthalene-2-carboxylic acid.
- Hydroxyethylsulphonemethylene-sulphinic acid.
- 5-Hydroxyfurfuran-2-carboxylic acid.
- β -Hydroxyglutaric acid.
- ζ -Hydroxyheptoic acid.
- p*-Hydroxyhydratropic acid.
- Hydroxymereuribenzoic acid.
- Hydroxymethanesulphonic acid.
- Hydroxymethoxynaphthalene-2-carboxylic acid.
- 3-Hydroxy-4-methoxyphenanthrene-9-carboxylic acid.
- β -Hydroxy- β -methyl- ϵ -heptenoic acid.
- Hydroxymethylhexoic acid.
- α -Hydroxy- α -methylisohexylacetic acid.
- 2-Hydroxymethyl-5-phenyl-3-triazole-1-propionic acid.
- 4-Hydroxy-2-methyltrimesic acid.
- 8-Hydroxynaphthalene-4:6-disulphonic acid.
- 2-Hydroxy- α -naphthaquinone-8-acetic acid.
- 2-Hydroxy-1-naphthylacetic acid.
- 2-Hydroxyisonicotinic acid.
- Hydroxypentanesulphonic acid.
- o*-, *m*-, and *p*-Hydroxyphenoxyacetic acids.
- Hydroxyphenylacetic acids.
- m*-Hydroxyphenylaminocrotonic acid.
- 4-Hydroxy-1-phenylpyrazole-3-carboxylic acid.
- 5-Hydroxyisophthalic acid.
- Hydroxypivalic acid.
- α -Hydroxyisopropyl- γ -hexenoic acid.
- 4-Hydroxypyrazole-3-carboxylic acid.
- Hydroxypyrimidinecarboxylic acid.
- Hydroxypyruvic acid.
- 8-Hydroxyquinolinecarboxylic acid.

Acids. See :—

- o*-Hydroxyquinolineglyeonic acid.
- o*-Hydroxyquinolinesulphonic acid.
- Hydroxystearic acid.
- Hydroxyterephthalic acid.
- β -Hydroxy- s -tetramethylglutaric acid.
- Hydroxytoluic acids.
- 1-Hydroxy-1:2:3-triazole-4:5-dicarboxylic acid.
- β -Hydroxy- $\alpha\alpha\beta$ -trimethyladipic acid.
- α - and γ -Hydroxyvaleric acids.
- Hygric acid (*1-methylpyrrolidine-2-carboxylic acid*).
- Idonic acid.
- Idosaccharic acid.
- Iminohydroxamic acid.
- Indeneoxalic acid.
- Indigotintrisulphonic acid.
- Indonecyanacetic acid.
- Indonedicarboxyloglutaconic acid.
- Indonemalonic acid.
- Japanic acid.
- 2-Ketohexamethylenecarboxylic acid.
- 2-Ketopentamethylenecarboxylic acids.
- 2-Ketophenemorpholinecarboxylic acids.
- Lactic acid.
- Lactopheninsulphonic acid.
- Lævulic acid.
- Laricinolic acid.
- Larinolic acid.
- iso*Lauronic acid.
- iso*Lauronolic acid.
- Leucine.
- Lutidinedicarboxylic acid.
- 2:6-Lutidyl-4-sulphonic acid.
- Malic acids.
- Malonic acid.
- Meconic acid.
- Mercuriacetic acid.
- Mercurisalicylic acid.
- Metahemipinic acid.
- Metapurpuric acid.
- Methazonic acid.
- β -Methoxy- β -benzylacrylic acid.
- p*-Methoxycinnamic acid.
- 6-Methoxyglauconic acid.
- Methoxyhydratropic acid.
- 6-Methoxyhydroglauconic acid.
- 5-Methoxy-7-methyl-1:3-diketohydrindene-4-mono- and -2:4-dicarboxylic acids.
- Methoxyphenanthrene-10-carboxylic acids.
- 4-Methoxyphenanthrene-9-carboxylic acid.
- β -*o*-Methoxyphenoxyacetic acid.
- o*-Methoxyphenylacetic acid.
- β -Methoxy- β -phenylacrylic acid.
- p*-Methoxyphenylcarbamic acid.
- α -*o*-Methoxyphenyl- β -*o*-nitroacetylvanillylacrylic acid.

Acids. See:—

α -*o*- and *p*-Methoxyphenyl-*o*-nitrocin-
namic acids.
 Methylacetyl-*p*-acetaminobenzoic acid.
 α - and β -Methylacrylic acids.
 α - and β -Methyladipic acids.
 Methylaminoembelic acid.
 α -Methyl- α ′-isomethylsuccinic acids.
 Methylaniliminocarbaminothiogly-
collic acid.
 Methylanthranilic acid.
 1-Methylbenzoxazole-4-carboxylic acid.
 α -Methyl- α ′-isobutylglutaric acid.
 β -Methyl-*tert*.-butylhydracrylic acid.
 4-Methyl-6-butyl-1:2-phthalic acid.
 α -Methyl- α ′-isobutylpropanetricarb-
oxylic acid.
 $\alpha\alpha$ ′-Methylisobutylsuccinic acids.
 α - and β -Methylbutyric acids.
 2-Methylcamphenepyrrole-3-carb-
oxylic acid.
 2-Methylcamphenepyrroline-3-carb-
oxylic acid.
 Methylcarboxyresoreylacetic acid.
 Methylcyanoacetic acid.
 Methylidilituric acid.
 Methylenemalononic acids.
 Methylenehydrazylacrylic acid.
 Methylenehydrazylacrylic acid.
 6-Methylglauconic acid.
 α - and β -Methylglutaric acids.
 β -Methyl- $\alpha\epsilon$ -heptadienoic acid.
 6-Methylhydroglauconic acid.
 1-Methyl-2-ketohexamethylenecarb-
oxylic acid.
 4-Methyl-2-ketopentamethylenecarb-
oxylic acid.
 Methylmalonic acid (*isosuccinic acid*).
 2-Methyl- α -naphthimidazolesulphonic
acid.
 Methylloxaluric acid.
 1-Methylcyclopentanonecarboxylic
acid.
 α -Methyl-*p*-isopropylcinnamic acid.
 α -Methyl- β -isopropylglutaric acids.
 $\alpha\alpha$ ′-Methylpropylsuccinic acids.
 1-Methyl-1-propyltrimethylenedicarb-
oxylic acid.
 3-Methylpyrazole-1-*p*-benzoic acid.
 2-Methylpyridine-6-carboxylic acid.
 1-Methylpyrrolidine-2-mono- and -2:2-
di-carboxylic acids.
 Methylresorcinolacetic acid.
 Methylsuccinic acid.
 α -Methyltetronic acid.
 Methyluracilcarboxylic acid.
 Methyluric acids.
 γ -Methylvaleric acid (*isohexanoic acid*).
 Methylvioluric acid.
 Mucic acid.
 Naphtha- β -ketopentamethyleneazine-
carboxylic acid.

Acids. See:—

Naphtha- β -ketopentamethyleneazine-
4-sulphonic acid.
 Naphthalene-1:3:5-trisulphonic acid.
 Naphthalic acid (1:8-Naphthalenedi-
carboxylic acid).
 Naphthaquinoneacetoacetic acids.
 Naphthaquinonebenzoylacetic acid.
 α -Naphthaquinonedimalonic acid.
 α -Naphthaquinoneisoinondedicarb-
oxylic acid.
 β -Naphthaquinone-4-malonic acid.
 Naphthaquinoneoxalacetic acid.
 Naphthaquinoneoxalinediacetic acids.
 1:2-Naphthazine-6:6′-disulphonic
acid.
 α -Naphtholcarboxylic acid.
 α -Naphthol-2-carboxy-3-malonic acid.
 α - and β -Naphthoxybutyric acids.
 β -Naphthoxycinnamic acids.
 α - and β -Naphthoxypropionic acids.
 α - and β -Naphthoxyisovaleric acids.
 α -Naphthoyl-*o*-benzoic acid.
 α - and β -Naphthylcarbamic acid.
 Naphthylcamphorformeneaminecarb-
oxylic acids.
 Naphthylhydrazidoxalhydroxamic
acids.
 Naphthylthiosulphonacetoacetic acids.
*iso*Nicotinic acid.
 "Nitroic acids."
 Norpic acid.
 Nucleic acids.
 Nucleothymic acid.
 Octanedicarboxylic acids.
 $\gamma\delta$ -*iso*Octenoic acid.
 Octenoic acid.
 Oleic acid.
 Opianic acid.
 Orcinobis- α -oxybutyric acids.
 Orcinobis- α -oxypropionic acid.
 Orcinobis- α -oxyisovaleric acid.
 Orcinoltricarboxylic acid.
 Oxalacetic acid.
 Oxalidacetic acid.
 Oxalic acid.
 γ -Oxalocrotonic acid.
 Oxaluric acid.
 α -Oximinoadipic acid.
 α -Oximino- β - and - γ -methyladipic
acids.
 α -Oximinopimelic acid.
 Oximinopropionic acid.
 Oxyhydroditeresantallic acid.
 Oxymethylphosphoric acid.
 Parabanic acid.
 Pentamethylene-tri- and -hexa-carb-
oxylic acids.
 Pentanedicarboxylic acid.
 Pentane-tri- and -hexa-carboxylic
acids.
 2-cycloPentanonecarboxylic acid.

Acids. See:—

Pentylenedicarboxylic acid.
 Perezone (*pipitzaholic acid*).
 Phenacetyl tartaric acid.
p-Phenethylcarbamidesulphonic acid.
 Phenoxylacetic acid.
α-Phenoxybutyric acids.
 Phenoxycinnamic acids.
 Phenoxylfumaric acid.
 Phenoxymaleic acid.
 Phenoxypropionic acid.
α-Phenoxyisovaleric acid.
 Phenylacethydroxamic acid.
 Phenylacetic acid.
ψ-Phenylacetic acid.
α-Phenyl-4-acetoxy-3-methoxycinnamic acid.
d-Phenylalanine.
 Phenylallene-carboxylic acid.
 Phenylaminoacetic acid.
 Phenylisocamylaminoacetic acid.
 1-Phenylbenzoxazole-4-carboxylic acid.
 Phenylisobutyric acid.
 Phenylcamphorformeneaminecarboxylic acid.
 Phenylcarbamic acid.
 Phenylcinnamic acids.
 Phenyl dimethoxycinnamic acids.
 Phenyl dimethyl dihydro pyridinecarboxylic acid.
 Phenyl dimethyl pyrazoleacetic acid.
p-Phenylenebis-2:5-dimethyl pyrrole-3:4-dicarboxylic acid.
p-Phenylenediamine-2:6-disulphonic acid.
 Phenylenedioxydiacetic acids.
 Phenylethylhydantoic acid.
β-Phenyl-*α*-ethylpropionic acid.
 Phenylfumaric acid.
 Phenylglycine-*o*-carboxylic acid.
 Phenylhydroxyhomocampholic acid.
 Phenyliminodiphenylacetic acid.
 1-Phenyl-4-ketopyrazoline-3-carboxylic acid.
 1-Phenyl-4-ketopyrazolone-3-carboxylic acid.
 Phenylmethoxycinnamic acids.
 Phenylmethylbutanonic acid.
 1-Phenyl-5-methyl-3:4-dicarboxylic acid.
 1-Phenyl-3-methylpyrazole-Bz-*p*-carboxylic acid.
 1-Phenyl-5-methylpyrazole-3:4-dicarboxylic acid.
 1-Phenyl-3-methylpyrazoloneazobenzeneazoacetic acid.
 Phenylparaconic acids.
 Phenylpropionic acid.
 Phenylpropionic acid.
 Phenylpyruvic acid.
 Phenylsulphonacetic acid.

Acids. See:—

Phenylsulphonpropionic acid.
 Phenyltartramic acid.
 Phenylthiocarbamic acid.
 Phenyl*di*thiocarbazinic acid.
 Phenylthioncarbazinic acid.
 Phenylthiosulphonacetacetic acid.
 Phenyltolylmethane-*p*-carboxylic acid.
 3-Phenyl-1:4:6-trimethyluric acid.
β-Phenyluraminocrotonic acid.
 Phenyluric acids.
 Phloretic acid.
 Phloroglucinolcarboxylic acid.
o-Phthalaldehydic acid.
 Phthalic acids.
 Phthalide-di- and tri-carboxylic acids.
 Phthalonanamic acid.
 Phthalonic acid.
 Phthaloylphthalic acid.
 Phthaloyltoluoylbenzoic acid.
 Phthalylaminoacetic acid.
α-Phthalyliminobutyric acid.
α-Phthalyliminopropionic acid.
 Picric acid.
 Pilocarpic acid.
 Piluvic acid.
i-Pinocampholenic acid.
 Pinolic acid.
i-Pinonic acid.
 Pipitzaholic acid (*perezone*).
 Plasmic acid.
 Polyaspartic acids.
 Prehnitic acid.
 Propanedicarboxylic acid.
*cyclo*Propanedicarboxylic acid.
 Propiolic acid.
 Propionic acid.
p-Propionylphenylcarbamic acid.
 Propiophenonecarboxylic acid.
β-Propoxy-*β*-phenylacrylic acid.
β-*iso*Propylacrylic acid.
 1-*iso*Propylbenzoxazole-4-carboxylic acid.
α-*iso*Propylbutyric acid (*heptioic acid*).
β-*iso*Propylglutaric acid.
α-*iso*Propylidene-*γ*-hexenoic acid.
β-*iso*Propyllævulinic acid.
*iso*Propylketocoumarancarboxylic acid.
 Propylmalonic acid.
β-*p*-*iso*Propylphenyl-*α*-methylhydroxyacrylic acid.
*aa*₁-Propyl*iso*propylsuccinic acid.
 Protocatechuic acid.
*iso*Purpuric acid.
 Pyrazole-3:5-dicarboxylic acid.
 Pyridinecarboxylic acids.
 Pyridine-2:6-dicarboxylic acid.
 Pyridoylacetic acids.
 Pyridyl-2-sulphonic acid.
 Pyridyl-2-thioglycollic acid.
 Pyrogallolsulphonic acid.

Acids. See:—

Pyromeconic acid.
 Pyromucic acids.
a-Pyrone-*a*'-carboxylic acid.
i-Pyrotartaric acid (*methylsuccinic acid*).
*iso*Pyrottritic acid.
 2-Pyrrolidinecarboxylic acid.
 Pyrroline-2-carboxylic acid.
 Pyruvic acid.
 Pyruvogycollic acid.
 Quinobis-*a*-oxybutyric acids.
 Quinobis-*a*-oxypropionic acid.
 Quinobis-*a*-oxyisovaleric acid.
 Quinolacetic acid.
 Quinolinenphenetoledicarboxylic acid.
 Quinolonic acid.
 Quinoxalidoneacetic acid.
 Resorcinobis-*a*-oxybutyric acids.
 Resorcinobis-*a*-oxypropionic acid.
 Resorcinobis-*a*-oxyisovaleric acid.
 Resorcinolacetic acid.
 Resorcinol-*o*-azosalicylic acid.
 Rhamninotronic acid.
 Ricinoleic acid.
 Rubeanic acid (*dithio-oxamide*).
 Sabinenic acid.
 Saccharic acid.
 Salicylanilinoacetic acid.
 Salicylic acid.
a-Salicyloxybutyric acids.
a-Salicyloxypropionic acid.
a-Salicyloxyisovaleric acid.
 Santalic acid.
 Santonic acids.
 Semicarbazinopropionic acid.
 Semicarbazylcamphorformenecarboxylic acids.
 Solanthic acid.
 Sorbic acid.
 Stearic acid.
 Strophanthic acid.
 Styrylcarbamic acid.
 Succinic acid.
 Succinylsuccinic acid.
p-Sulphobenzeneazodiphenylaminesulphonic acid.
p-Sulphocinnamic acid.
 4-Sulpho-1:2-naphthaquinoxalinediacetic acid.
 Sulphonaphthylstearic acid.
 Sulphophenylstearic acid.
 Sulphosalicylic acid.
a-Tanacetogendicarboxylic acid.
 Tanacetonedicarboxylic acid.
 Tannic acid.
 Tartaric acids.
 Tartromalic acids.
 Tartronic acid.
 Telfairic acid.
 Terephthalic acid.
 Tersantallic acid.

Acids. See:—

Tetrahydrofurfuran-2:5-dicarboxylic acid.
 Tetrahydroquinolyl-2-propionic acid.
 Tetrahydroxylic acid.
 Tetramethylapionolcarboxylic acid.
cis-Tetramethylene-1:3-dicarboxylic acid.
 Tetramethylglutaric acids.
 Tetramethylpyrrolidinecarboxylic acid.
 Tetronic acid.
 Tetronosulphonic acid.
a- ψ -Thebaolcarboxylic acid.
 Thiocyanic acid.
 Thioncarbamic acid.
 Thioncarbanilic acid.
 Thymic acid.
a-Thymoxybutyric acids.
a-Thymoxypropionic acid.
a-Thymoxyisovaleric acid.
o-Toluenaezotolyicarhamic acid.
 Tolueneatricarboxylic acid.
o-Toluidinoembolic acid.
p-Toluoylbenzoic acids.
 Tolnonylcarbinolbenzoic acid.
p-Toluoyl- β -propionic acid.
 Toloric acids.
 Tollysbutyric acid.
p-Tolylcarbazinic-*a*-carboxylic acid.
a-Tolyloxybutyric acids.
 β -Tolyloxycinnamic acids.
 Tolyloxyfumaric acids.
m-Tolyloxymaleic acid.
 Tolyloxypropionic acids.
a-Tolyloxyisovaleric acid.
p-Tolythionisulphonacetacetic acid.
 1:2:3-Triazole-4-mono- and -4:5-dicarboxylic acids.
 2:3:4-Trihydroxybenzoic acid.
 Trihydroxybutyric acid.
i-Trihydroxyglutaric acid.
 Triketosantonnic acid.
 Trimercuriacetic acid.
 2:3:4-Trimethylbenzoic acid (*prehni-tylic acid*).
 $\alpha\beta\beta$ -Trimethylbutane- $\alpha\alpha\beta$ -tricarboxylic acid.
 $\alpha\beta\beta$ -Trimethylbutyric acid.
 2:4:6-Trimethyldihydropyridinedicarboxylic acid.
 Trimethyldihydroresoreylic acid.
trans-Trimethylenedicarboxylic acid (*cyclopropanedicarboxylic acid*).
 $\alpha\beta\beta$ -Trimethylglutaric acid.
 2:4:5-Trimethylhippuric acid.
 Trisbisdiazomethanetetra-carboxylic acid.
 Tyrosines.
 Undecane-di- and -tri-carboxylic acids.
 Undecenoic acid.
 Uric acid.
 Urochloralic acid.

Acids. See:—

Usnic acid.
Usmonic acid.
Valeric acids.
 γ -Valerolactone-*Sy*-dicarboxylic acid.
Veratric acid.
Vinylacetic acid.
Vinylthioethylenethioglycollic acid.
Violuric acid (*nitrosobarbituric acid*).
Xanthic acid.
m-Xylylcarbamic acid.
 α -Xylyloxybutyric acids.
 α -Xylyloxypropionic acids.
 α -Xylyloxyisovaleric acids.
o-Xylylphthaloylic acid.

Aconite alkaloids (DUNSTAN and READ), T., 45; P., 1899, 206.

Aconitine, action of iodine on (KIPPENBERGER), A., ii, 777.
value of tests for (MECKE), A., ii, 121.

Aconitum Napellus, comparison of the properties of the alkaloids from, with those from Japanese aconite (DUNSTAN and READ), T., 63.

Acraldehyde (*acrolein*), detection of (LEWIN), A., ii, 179.

Acridine derivatives, action of form-aldehyde on (KOENIGS), A., i, 190.

Acridine series, syntheses in the (ULLMANN and NAEF), A., i, 360, 361, 689.

Acroses, α - and β -, from glycollic aldehyde (JACKSON), T., 129; P., 1899, 238.

Acrylic acid, anhydrous (BILLMANN), A., i, 473.

methods for the preparation of (BILLMANN and WÖHLK), A., i, 425.

preparation of, from allyl alcohol (BILLMANN), A., i, 425.

preparation of, from glycerol (WÖHLK), A., i, 425.

Acrylic acid, α -chloro-, and its ethyl ester (MELIKOFF), A., i, 536.

Actinium (DEBIERNE), A., ii, 20, 350.

Address, presidential (THORPE), T., 555; P., 1900, 77.

n-Adipic acid (*butanedicarboxylic acid*), thermochemistry of (MASSOL), A., ii, 260.

Adlumia cirrhosa, protopine from (SCHLOTTERBECK), A., ii, 746.

Adsorption, experiments on (VRIENS), A., ii, 202.

AFFINITY, CHEMICAL:—

Association, molecular, in liquids (BERTHELOT), A., ii, 335, 337.

Chemical affinity (VAUBEL), A., ii, 264, 590.

Affinity coefficients of saturated fatty acids (BILLITZER), A., i, 7.

AFFINITY, CHEMICAL:—

Affinity constants of acids containing a ring of seven carbon atoms (ROTH), A., ii, 590.

of nitrous acid (SCHÜMMANN), A., ii, 264.

Dilution law (BANCROFT), A., ii, 186.

Mass law, the, and physical reactions (LINCOLN), A., ii, 392.

Modulus law (PONSOT), A., ii, 392.

Chemical change, function of the medium in (BRÜHL), A., ii, 11.

Chemical reactions (MICHAEL), A., i, 321.

characteristics of certain (GIBSON), A., ii, 198.

auxiliary (WEGSCHEIDER), A., ii, 199, 532.

kinetics of, with auxiliary reactions (WEGSCHEIDER), A., ii, 199.

influence of magnetism on (DE HEMPTINNE), A., ii, 707.

in water and acetone (ROHLAND), A., ii, 468.

in solution (PONSOT), A., ii, 337.

in heterogeneous systems (WILDERMANN), A., ii, 200.

limited, in homogeneous systems (PONSOT), A., ii, 392.

reversible: lecture experiments (MILLER and KENRICK), A., ii, 534.

between hydrogen chloride and silver (JOUNIAUX), A., ii, 139.

between metals (COLSON), A., ii, 140.

Catalytic actions, theory of (EULER), A., ii, 532.

an addition to the theory of (WEGSCHEIDER), A., ii, 532.

of alkali in oxidation processes (MANCHOT), A., i, 300.

of various substances in oxidation processes (v. GEORGIEVICS and SPRINGER), A., i, 560.

of some metals (SULC), A., ii, 395.

Catalytic agents, influence of, on oxidation (JONISSEN and REICHER), A., ii, 200.

Catalysis of normal salts (EULER), A., ii, 269.

Chemical equilibrium and electromotive force (ROTHMUND), A., ii, 183; (DANNIEL), A., ii, 464.

numerical laws of (BOUDOUARD), A., ii, 199.

of heterogeneous systems, the law of (WILDERMANN), A., ii, 200.

in a system of four gases (PÉLABON), A., ii, 265.

in the partition of an acid between ammonia and cadmium hydroxide (HERZ), A., ii, 532.

AFFINITY, CHEMICAL :—

Chemical equilibrium in the partition of an acid between zinc hydroxide and ammonia (HERZ), A., ii, 337.
 between hydrogen peroxide and "persulphuric acid" (LOWRY and WEST), T., 955; P., 1900, 127.
 between manganous salts and ammonia (HERZ), A., ii, 68.
 in precipitated silver bromide and iodide (THIEL), A., ii, 521.
 of carnallite (VAN'T HOFF and MEYERHOFFER), A., ii, 12.
 between benzenesulphoncamphylamide and sodium hydroxide solution (DUDEN), A., ii, 267.

Decomposition by sodium of organic halogen compounds dissolved in amyl alcohol (LÖWENHERZ), A., ii, 338.

Hydrolysis of salt solutions (LEY), A., ii, 67, 731; (BRUNER), A., ii, 268.

in organic solvents (CAJOLA and CAPPELLINI), A., ii, 394.

of the sodium salts of weak inorganic acids, in relation to their dissociation constants (WALKER), A., ii, 268.

of metallic salts (CARRARA and VESPIGNANT), A., ii, 647.

of chlorine compounds of gold, platinum and tin on standing, and under the influence of light (KOHLEAUSCH), A., ii, 408.

of silicon and titanium tetrachlorides (v. KOWALEWSKY), A., ii, 731.

of stannic chloride solutions (v. KOWALEWSKY), A., ii, 256.

of amylogen and starch (SYNIEWSKI), A., i, 78.

of polysaccharides (ŠULC), A., ii, 395.

of phenol and its *mono*-, *di*-, and *tri*-chloro-, cyano-, and nitro-derivatives (HANTZSCH), A., i, 95.

Partition of ammonia between chloroform and aqueous solutions of metallic salts (DAWSON and McCRAE), T., 1241; P., 1900, 172.

Velocity of acetylation of primary and secondary amines (MUSSELLIUS), A., i, 334; (MENSCHUTKIN), A., i, 341.

Velocity of graded actions (WALKER), A., ii, 198.

Velocity of change of white into grey tin (COHEN and VAN RIJK), A., ii, 83, 212; (COHEN), A., ii, 212.

Velocity of combination of secondary amines and alkyl bromides (MENSCHUTKIN), A., i, 335, 341.

AFFINITY, CHEMICAL :—

Velocity of decomposition of hydrogen peroxide by colloidal platinum (BREDIG and MÜLLER v. BERNECK), A., ii, 214.

Velocity of diasotisation (SCHÜMANN), A., ii, 264.

Velocity of displacement of halogens from halogenated fatty acids (DE BARR), A., i, 76.

Velocity of esterification of phosphoric acid by glycerol (IMBERT and BELUGOU), A., i, 130.

Velocity of formation of esters from benzoic chloride and fatty alcohols (BRUNER and TOLLOCHKO), A., ii, 648.

of bromobenzene (BRUNER), A., ii, 647.

of carbamide from solid ammonium cyanate (WALKER and WOOD), T., 30; P., 1899, 209.

of olefines (BRUSSOFF), A., i, 322.

Velocity of hydrolysis in heterogeneous systems (GOLDSCHMIDT and MESSERSCHMITT), A., ii, 200.

of ethyl acetoacetate (GOLDSCHMIDT and OSLAN), A., i, 132, 373.

of ethyl acetate, effect of sugars on the (COHEN), A., ii, 716.

of methyl acetate (COJAZZI), A., i, 327; (DE HEMPTINNE), A., ii, 199; (CAJOLA and CAPPELLINI), A., ii, 394.

of esters of formic, acetic, and propionic acids at various temperatures, (PRICE), A., ii, 528.

of ethyl dimethylacetoacetate (GOLDSCHMIDT and OSLAN), A., i, 373.

Velocity of inversion of sugar, influence of normal salts on (ARRHENIUS), A., ii, 201.

Velocity of oxidation, influence of catalytic agents on the (JORISSEN and REICHER), A., ii, 200.

Velocity of reaction before complete equilibrium and before transition points (WILDERMANN), A., ii, 200.

influence of the medium on the (BUCHBÖCK), A., ii, 590.

in isomeric benzene derivatives, influence of chemically indifferent solvents on (MENSCHUTKIN), A., i, 341.

of acids in organic solvents (GEIGER), A., ii, 394.

of acetic acid and primary and secondary amines (MUSSELLIUS), A., i, 334; (MENSCHUTKIN), A., i, 341.

AFFINITY, CHEMICAL:—

Velocity of reaction between benzaldehyde and sodium hydroxide (POMERANZ), A., i, 552.

of bromine on phenylsulphon-acetic and -propionic acids (RAMBERG), A., ii, 717.

of hydroxy-methane-, -ethane-, and -pentane-sulphonic acids (COJAZZI), A., i, 327.

Velocity of solidification and viscosity of supercooled liquids (WILSON), A., ii, 712.

Agar, equilibrium between water and (HARDY), A., ii, 396.

Agaricus campestris, composition of (ZEGA), A., ii, 498.

Agaricus phalloides, constituents of (KOBERT), A., ii, 156.

Agglutination, mechanism of (EENST and ROBEY), A., ii, 560.

of blood corpuscles by chemical agents (HÉDON), A., ii, 665.

Agoniatin, identity of, with plumieride (FRANCHIMONT), A., i, 680.

AGRICULTURAL CHEMISTRY—

ANIMALS, DAIRY PRODUCTS, FEEDING EXPERIMENTS:—

Bullocks, metabolism in full-grown, with maintenance and fattening foods (KELLNER and KÖHLER), A., ii, 563, 565, 566.

Calves, milk and artificial foods for fattening (DICKSON and MALPEAUX), A., ii, 566.

Cows, feeding experiments on (RAMM and MINTROP), A., ii, 39; (VIRCHOW), A., ii, 93; (ALBERT), A., ii, 103; (RAMM and MÖLLER), A., ii, 104, 503; (ARENANDER), A., ii, 236; (HILLS), A., ii, 236, 568; (HAGEMANN), A., ii, 502.

See also Butter, Milk, and Feeding experiments.

Dogs, hæmorrhage and transfusion in (DAWSON), A., ii, 291, 417.

results of the extirpation of liver in (SALASKIN and ZALESKI), A., ii, 607.

feeding experiments on (VIRCHOW), A., ii, 93.

Horses, metabolism in (PFEIFFER), A., ii, 554.

amount of iron present in the hæmoglobin of (LAPICQUE and GILARDONI), A., i, 467.

blood molasses as food for (LILIEN-THAL), A., ii, 502.

Pigs, feeding experiments on (VIRCHOW), A., ii, 93.

blood molasses as food for (LILIEN-THAL), A., ii, 532.

AGRICULTURAL CHEMISTRY: ANIMALS:—
Ruminants, metabolism in (HAGEMANN), A., ii, 222.

Sheep, influence of asparagine and ammonia on proteid metabolism in (KELLNER, KÖHLER, BARNSTEIN, ZIELSTORFF, EWERT, and WEDEMEYER), A., ii, 417.

DAIRY PRODUCTS:—

Butter from various countries compared (ESTCOURT), A., ii, 452.

composition of (RICHMOND), A., ii, 696.

Danish, composition of (FABER), A., ii, 696.

origin of volatile fatty acids in (ZUNTZ and USSOW), A., ii, 689.

effect of food on the hardness and composition of (BARTLETT), A., ii, 567.

effect of food on the quality of (HILLS), A., ii, 236, 568.

effect on, of feeding cows with cotton and sesamé cake (THEORPE), A., ii, 237.

effect on, by feeding cows with sesamé cake (WEIGMANN), A., ii, 40; (SCHEIBE; VIETH), A., ii, 236.

chemical action of mould on (HANUŠ and STOKČŮ), A., ii, 772.

rancidity of (BROWNE), A., ii, 115; (HANUŠ), A., ii, 634.

nutritive value of margarine and, compared (BERTARELLI), A., ii, 224.

relative digestibility of margarine and, in the human intestine (LÜHRIG), A., ii, 224, 667.

methods of analysis. See Main Index.

Cheese, detection of margarine in (FASCETTI and GHIGI), A., ii, 377.

"**Manur**," composition of (ZEGA), A., ii, 503.

Cream, composition of (RICHMOND), A., ii, 696.

Milk, composition of (RICHMOND), A., ii, 696.

constancy in the composition of, and detection of its adulteration (TIMPE), A., ii, 251.

relation between the specific gravity, fat, and solids not fat in (LEONARD), A., ii, 376.

effect of fatigue on the quantity and quality of (HILLS), A., ii, 567.

source of the fat of (CASPARI), A., ii, 163.

composition of the fat of (BROWNE), A., ii, 55.

AGRICULTURAL CHEMISTRY: DAIRY PRODUCTS:—

- Milk**, changes in the constants of fat of, under the influence of feeding (RUFFIN), A., ii, 324.
 effect of feeding fat on the quality of (BARTLETT), A., ii, 567, 568; (HILLS), A., ii, 568; (HENRIQUES and HANSEN), A., ii, 668.
 proteids of (STORCH), A., i, 266.
 galactase, the proteolytic ferment of, and its action on the proteids of (BABCOCK and RUSSELL; v. FREUDENREICH), A., i, 712.
 sour (RICHMOND and HARRISON), A., ii, 451.
 effect of different substances on the curdling of (BOKORNY), A., ii, 297.
 value of certain antiseptics in (BABCOCK, RUSSELL, and VIVIAN), A., ii, 560.
 effect of preservatives on (SCHULZE), A., ii, 251.
 boric acid and formaldehyde as preservatives of (RIDEAL and FOULERTON), A., ii, 560; (HEHNER), A., ii, 561.
 methods of analysis. See Main Index.

FEEDING EXPERIMENTS:—

- Asparagine**, nutritive value of (BRUTSKUS), A., ii, 237.
Atriplex semibaccata, composition and food value of (JAFFA), A., ii, 539.
Bassia nut and cake as food for cows (RAMM and MÖLLER), A., ii, 503.
Beans, French and Hungarian (KOSUTÁNY, WINDISCH, v. HÉRICHS-TÓTH, v. SZÉLL, and FALTIN), A., ii, 750.
Beet molasses of different origin (KELLNER, PETERS, ZAHN, and STRIGEL), A., ii, 566.
Blood molasses as food for cows (RAMM and MINTROP), A., ii, 39; (LILIENTHAL), A., ii, 502; (STROHMER), A., ii, 681.
 as food for horses and pigs (LILIENTHAL), A., ii, 502, 682.
Brewery residues as food for cows (RAMM and MÖLLER), A., ii, 104.
Cakes, various, value of, as foodstuffs (v. KNIERIEM), A., ii, 39.
Cane-sugar, maize-gluten, and malt-germ molasses as foods for cows (RAMM), A., ii, 749.
Cotton seed oil, feeding experiments on dogs and pigs with (VIRCHOW), A., ii, 98.
English cake as food for cows (RAMM and MÖLLER), A., ii, 503.

AGRICULTURAL CHEMISTRY: FEEDING EXPERIMENTS:—

- Feeding stuffs**, digestibility of some non-nitrogenous constituents of some (FRAPS), A., ii, 748.
Fodders, composition of (EMMERLING), A., ii, 614.
Gluten- and starch-meal as food for bullocks (KELLNER and KÖHLER), A., ii, 563; (KELLNER, KÖHLER, BARNSTEIN, ZIELSTORFF, LÜHBIG, and MACH), A., ii, 565.
Gluten- and starch-meal and earth nut oils as food for bullocks (KELLNER and KÖHLER), A., ii, 563; (KELLNER, KÖHLER, ZIELSTORFF, HERING, EWERT, and LEHMANN), A., ii, 565.
Grain, mixed, and maize, as food for cows (FRIIS), A., ii, 615.
Maize-germ molasses, as food for cows (SCHULZE), A., ii, 502.
Meadow hay, oat straw, starch meal, and molasses as food for bullocks (KELLNER and KÖHLER), A., ii, 563; (KELLNER, KÖHLER, LEHMANN, HERING, WEDEMEYER, and METHNER), A., ii, 566.
Meadow hay, wheat straw, starch meal, extracted rye straw, and molasses as food for bullocks (KELLNER and KÖHLER), A., ii, 563; (KELLNER, KÖHLER, LEHMANN, HERING, WEDEMEYER, VOLHARD, PETERS, v. GILLERN, and ZAHN), A., ii, 566.
Molasses as food for cows (HOPPE), A., ii, 681.
 non-saccharine matter of, as food for cows (RAMM and MONSEN), A., ii, 750.
Oil cakes, composition of (EMMERLING), A., ii, 614.
Palm kernels, crushed, as food for cows (VIETH), A., ii, 682.
Peat-meal molasses, (WOY), A., ii, 682.
Rape cake, development and injurious effect of mustard oil in (SJOLEMA), A., ii, 613.
Rye as food (v. KNIERIEM), A., ii, 748.
Tropon as food for cows (RAMM and MÖLLER), A., ii, 503.
Vetches as food (v. KNIERIEM), A., ii, 749.

PLANTS.

PLANT COMPOSITION AND METABOLISM:—

- Plants**, formation and decomposition of albumin in (SCHULZE), A., ii, 612.

AGRICULTURAL CHEMISTRY: PLANTS:—

Plants, formation of amino-acids and proteids in (EMMERLING), A., ii, 612.

distribution of cane-sugar in (ANDERSEN), A., ii, 561.

chromium, molybdenum, and vanadium in (DEMARÇAY), A., ii, 235.

copper in (MACDOUGAL), A., ii, 235.

formation of formaldehyde in (POL-LACCI), A., ii, 160, 426.

lithium in (TSCHERMAK), A., ii, 235.

occurrence of myrosin in (BOKORNY), A., ii, 746.

proteids in (BOKORNY), A., ii, 426 ; (EMMERLING), A., ii, 612.

conditions of the production of living proteids in, and their importance in the respiration of (PALLADIN), A., ii, 612.

proteid metabolism in (SCHULZE), A., ii, 745.

amount of sulphur in (BOGDANOFF), A., ii, 160.

genesis of terpenic constituents in (CHARABOT), A., i, 241, 303 ; ii, 101, 361, 362.

relation of the ash to the height of (MILLS, IMRIE, and GRAY), A., ii, 496.

action of dry and moist air on (EBERHARDT), A., ii, 561.

effect of manuring on the inner processes of some (MÜLLER-THURGAU), A., ii, 506.

nutrition of, with organic nitrogenous compounds (LUTZ), A., ii, 233.

absorption of iodine by (BOURCET), A., ii, 100.

absorption of soluble salts by (DEMOUSSEY), A., ii, 161.

utilisation of potash in soil by (SCHLESING), A., ii, 806.

assimilation by, in soils containing different amounts of sand (GROSS), A., ii, 363.

chlorophyllous, phosphorus compound first formed in (POSTERNAK), A., ii, 679.

etiolated, changes produced in (ANDRÉ), A., ii, 423.

medicinal, ashes of some (GRIFFITHS), A., ii, 679.

importance of, used for green-manuring in increasing the amount of nitrogen in the soil (LARSEN), A., ii, 505.

PLANTS:—

Ashes of some medicinal plants (GRIFFITHS), A., ii, 679.

VOL. LXXVIII. ii.

AGRICULTURAL CHEMISTRY: PLANTS:—

Cell, chemistry of the (SOSNOWSKI), A., ii, 100.

production of sucrose from dextrose in the (GROSS), A., ii, 361.

Chlorophyll, chemistry of (MARCHLEWSKI and SCHUNCK), T., 1080 ; P., 1900, 148.

formation of, in the dark (RADAIS), A., ii, 362.

decomposition of, by oxidising enzymes (WOODS), A., ii, 234.

assimilation of, induced by sunlight filtered through leaves (GRIFFON), A., ii, 159.

Chlorophyllous assimilation, influence of pressure on (FRIEDEL), A., ii, 679.

in indoor plants (GRIFFON), A., ii, 426.

Leaves, yellow colouring matters of, and their spectrum (SCHUNCK), A., ii, 36.

Root nodules of alder and Elæagnus (HILTNER), A., ii, 426.

of leguminous plants, nature and functions of (STOKLASA and DAWSON), A., ii, 610.

value of, in lupin cultivation (DEHÉRAIN and DEMOUSSEY), A., ii, 238.

leguminous, action of, in water cultures (NOBBE and HILTNER), A., ii, 234.

Root secretions (CZAPEK), A., ii, 234.

Roots, influence of nitrogen on the growth of (MÜLLER-THURGAU), A., ii, 361.

Seeds, action of anæsthetic vapours on (COUPIN), A., ii, 35.

effect of ferments on the germination of (THOMSON), A., ii, 496.

influence of the temperature of liquid hydrogen on the germinative power of (THISELTON-DYER), A., ii, 300.

changes in the mineral and organic constituents of, during germination (ANDRÉ), A., ii, 159, 300.

digestion of the reserves in, during germination, and their assimilation by the seedlings (MAZÉ), A., ii, 300.

germinating, proteolytic ferments of (HARLAY), A., ii, 744.

occurrence and action of proteolytic ferments in (BUTKEWITSON), A., ii, 744.

Stems, absorption of water and dissolved substances by (BRÉAL), A., ii, 35.

AGRICULTURAL CHEMISTRY: PLANTS:—

Tissues, furfuroids of (CROSS, BEVAN, and REMINGTON), A., ii, 611.

Respiration, importance of "living" proteid in (PALLADIN), A., ii, 613.

Plant growth, importance of Bacteria in (STOKLASA), A., ii, 360.

sugar as an aid to (GOLDING), A., ii, 617.

toxic action of compounds of the alkaline-earth metals towards (COUPIN), A., ii, 363; (SUZUKI), A., ii, 561.

poisonous properties of sodium chloride and sea water towards (COUPIN), A., ii, 236.

Germination (MAQUENNE), A., ii, 678.
action of calcium hydroxide on (WINDISCH), A., ii, 614.

PLANTS:—

Agaricus campestris, composition of (ZEGA), A., ii, 498.

Agaricus phalloides, constituents of (KOBERT), A., ii, 156.

Apios tuberosa, composition of (BRIGHETTI), A., ii, 498.

Apple trees, material for the nutrition of (HOTTER), A., ii, 745.

Astragalus caryocarpus, fruit of (FRANKFORTER), A., ii, 747.

Barley, manurial experiments on (HANAMANN), A., ii, 41, 752; (PRIANISCHNIKOFF), A., ii, 237; (BAESSLER), A., ii, 307.

Barley grain, relation between the weight of, and percentage of nitrogen in the (JOHANNSEN), A., ii, 363.

Beans, effect of alinit and nitragin on (CAMPBELL), A., ii, 433.

Beetroot (sugar), composition of very rich (GRAFTIAU), A., ii, 430.

cultivation of (WILFARTH and WIMMER), A., ii, 365.

experiments with, in 1898 (STONE, CLINTON, KINSELY, and CAVANAUGH), A., ii, 501.

amount of mineral matter and nitrogen in, variously manured and in different soils (SCHNEIDERWIND), A., ii, 364.

assimilation by (WILFARTH), A., ii, 163.

effect of perchlorate in sodium nitrate on the growth of (STOKLASA), A., ii, 305.

seed, does nitrogenous manure injure? (WILFARTH), A., ii, 366.

influence of potash manures on the development of (STOKLASA), A., ii, 163.

physiological importance of furfuroids in (STOKLASA), A., ii, 100.

AGRICULTURAL CHEMISTRY: PLANTS:—

Beetroot (sugar) excrescences, mites in (BUBÁK), A., ii, 501.

Beet leaves, dextrose and levulose in (LINDET), A., ii, 302.

estimation of oxalic acid in (BÜLOW), A., ii, 322.

Cereals, use of alinit in the cultivation of (MALPRAUX), A., ii, 498.

Clover hay, manurial experiments on (CAMPBELL), A., ii, 429.

Coniferous plants, arginine from (SUZUKI), A., ii, 562.

Conifer seeds, decomposition products of proteids of (SCHULZE and WINTERSTEIN), A., ii, 101.

Copper beech, distribution of the ash constituents in sections of the (HORNBERGER), A., ii, 496.

Cork oak (TASSELLI), A., ii, 750.

Crops, basic constituents of (WARRINGTON), A., ii, 569; (DEMOUSSEY), A., ii, 570.

effect of rain and of the nature of the soil on the production of (PAGNOUL), A., ii, 306.

intermediate, accumulation of nitrogen by the cultivation of (MAERCKER), A., ii, 102.

Euonymus alatus, dulcitol in the bark of (HOEHNEL), A., ii, 427.

Euonymus japonicus, "honey" of (MAQUENNE), A., ii, 161.

Fenugreek, composition of (D'ANCONA), A., ii, 364.

Fenugreek seeds, carbohydrates in (BOURQUELOT and HÉRISSEY), A., ii, 301.

enzyme of (BOURQUELOT and HÉRISSEY), A., ii, 233.

Flax, manuring experiments on (OLSCHOWY), A., ii, 500.

Fodder plants, vegetation of (MONVOISIN), A., ii, 303.

Fruit trees, manurial experiments on (STEGELICH), A., ii, 570.

Gramineae, presence of invertase in some plants of the (O'SULLIVAN), T., 691; P., 1900, 61.

Hay, influence of fermentation on the nutritive value of (HOLDEFLEISS), A., ii, 238.

of *Molinia caerulea* and *Carex Goodenowii*, composition of (IMMENDORFF), A., ii, 162.

Norwegian, composition of (WERENSKIÖLD), A., ii, 304.

Hemp, cultivation of (SAMOGGIA), A., ii, 750.

Hollyhock flowers, composition of (ZAY), A., ii, 563.

AGRICULTURAL CHEMISTRY: PLANTS:—

Hops, manuring of (HANAMANN and KOURINSKY), A., ii, 163.
bitter principles of (BARTH), A., ii, 746.

Horse beans, experiments with, in different soils (SEISSEL and GROSS), A., ii, 430.

Indigo plants, occurrence of indican in the chlorophyll grains of (MOLISCH), A., ii, 101.

Kohl-rabi, manurial experiments on (OTTO), A., ii, 753.

Leguminosae, accumulation of asparagine in (BRÉAL), A., ii, 301.
effect of removing the flowers on the assimilation of nitrogen by (SOAVE), A., ii, 496.

Lettuce, manurial experiments on (OTTO), A., ii, 753.

Lotus corniculatus, Italian, composition of (D'ANCONA), A., ii, 161.

Lucerne, cultivation of, at Grignon (DEHÉRAIN), A., ii, 681.
manuring experiments on (MAERCKER), A., ii, 41.

Lupins, manuring experiments on (ULBRICHT), A., ii, 240.
percentage of alkaloids and corn from various (SEMPOLOWSKI), A., ii, 103.

blue and perennial, alkaloids from (CALLSEN), A., i, 186.

blue, cultivation of (DEHÉRAIN and DEMOUSSY), A., ii, 304.

white, cultivation of (DEHÉRAIN and DEMOUSSY), A., ii, 238.

yellow, effect of nitratin and inoculation soil on (ADLER), A., ii, 501.

Lupinus albus, toxic action of acids and of their sodium salts on (TRUE), A., ii, 303; (KAHLENBERG and AUSTIN), A., ii, 747.

Lupinus luteus seedlings, decomposition products of the proteids of (SCHULZE), A., ii, 101.

Maize, manuring experiments on (JENKINS), A., ii, 41; (MAZÉ), A., ii, 499.

as a food in Servia (ZEGA and MAJSTOROVIC), A., ii, 39.

Mangel-wurzel, cultivation of, at Grignon (DEHÉRAIN), A., ii, 680.
experiments with English, German, and French varieties of (WOHLTMANN), A., ii, 501.

changes in the composition of, during storage (MILLER), A., ii, 430.

Mulberry trees, cultivation of (ALFE), A., ii, 617.

AGRICULTURAL CHEMISTRY: PLANTS:—

Oats, cultivation of, at Grignon (DEHÉRAIN), A., ii, 303.

manuring with basic slag and superphosphate (BAESSLER), A., ii, 307.

effect of alinit and nitratin on (CAMPBELL), A., ii, 433.

distribution of the diastatic enzyme in (MAYER), A., ii, 427.

Olives, compressed, changes in, when stored under different conditions (KLEIN), A., ii, 615.

Olive seeds, composition of, before and after germination (SANI), A., ii, 613.

Paranip, cultivation of (GUÉPIN), A., ii, 751.

Pear trees, material for the nutrition of (HOTTER), A., ii, 745.

composition of the branches of, removed by regular thinning (PASSERINI), A., ii, 162.

Peas, manuring experiments on (LUTOSLAWSKI), A., ii, 99.

germination and growth of, in solutions of salts of fatty acids (LÖVINSON), A., ii, 744, 745.

Phenogams, can barium and strontium replace calcium in? (SUZUKI), A., ii, 561.

Phaseolus multiflorus, changes in the mineral constituents of the seed of, during germination (ANDRÉ), A., ii, 159.

Plane-tree leaves, food-stuffs of (TUCKER and TOLLENS), A., ii, 35.

Potato parings, formation of vanillin in (BRÄUTIGAM), A., ii, 427.

Potato plant, distribution of the diastatic enzyme in the (MAYER), A., ii, 427.

Potatoes, cultivation of, at Grignon (DEHÉRAIN), A., ii, 680.

manurial experiments on (GORDON), A., ii, 238; (SJOLLEMA), A., ii, 304, 305.

influence of water and manures on the activity and development of (WILMS), A., ii, 164.

influence of Stassfurt salts on the composition and yield of (SJOLLEMA), A., ii, 305; (PFEIFFER), A., ii, 751.

Rye, chemical alteration of, on becoming mouldy (SCHERPE), A., ii, 429.

Rye straw, weak, composition of (MURRAY), A., ii, 498.

Sainfoin, cultivation of, at Grignon (DEHÉRAIN), A., ii, 681.

Saw palmetto (*Sabal serrulatum*), fruit of (SHERMAN and BRIGGS), A., ii, 102.

AGRICULTURAL CHEMISTRY: PLANTS:—

Spruce fir, relation of ash to the height of a (MILLS, IMRIE, and GRAY), A., ii, 496.

Sugar-cane, experiments on, in Hawaii (MAXWELL), A., ii, 304.

Tobacco plants (BEHRENS), A., ii, 239. manurial experiments on (JENKINS), A., ii, 239.

Tomatoes, use of fertilisers for (JENKINS and BRITTON), A., ii, 365.

Vine, effects of chlorosis in the (CURTEL), A., ii, 428.

oxidising enzyme in the (CORNU), A., ii, 102.

Wheat, cultivation of, at Grignon (DEHÉRAIN), A., ii, 803.

chemical alteration of, on becoming mouldy (SCHERPE), A., ii, 429.

Wheat germ, oil from (FRANKFORDER and HARDING), A., ii, 87.

nucleic acid and proteids of the (OSBORNE and CAMPBELL), A., i, 573.

Flour, gluten constituents of (GUESS), A., ii, 584.

SOILS.

Agricultural land of the Essex coast, injury to, by inundation of sea-water in 1897 (DYMOND and HUGHES), A., ii, 307.

Soil, distribution and importance of fufuroids in (STOKLASA), A., ii, 40.

composition of, under manure heaps, at different depths (EMMERLING and WEHNERT), A., ii, 505.

denitrification and decomposition of animal matters in (ROGÓYSKI), A., ii, 360.

chemically analysed, manuring experiments on (BAESSLER), A., ii, 240.

practical conclusions from the results of (DOERSTLING), A., ii, 752.

testing of, for application of fertilisers (WEBER), A., ii, 165.

methods of ascertaining the lime requirement of (WHEELER, HARTWELL, and SARGENT), A., ii, 432.

effect of nitrogen, gypsum, and lime on (WHEELER, SARGENT, and HARTWELL), A., ii, 104.

behaviour of water-soluble phosphoric acid in (ULLMANN and GRIMM), A., ii, 431.

inoculation of, with nitrugin (FRANK), A., ii, 298; (NOBBE and HILTNER), A., ii, 299.

alluvial, of Lodi, composition of the (FASCETTI and GHIGI), A., ii, 615.

AGRICULTURAL CHEMISTRY: SOILS:—

Soil, arable, effect of carbon disulphide on the fertility of (WOLLNY), A., ii, 504.

amount of phosphoric acid necessary for (PAGNOUL), A., ii, 164.

meadow, action of manures on (MAERCKER), A., ii, 42; (NESSLER), A., ii, 162; (MALDEN), A., ii, 240; (BRIGHTT), A., ii, 303;

(LAWES and GILBERT), A., ii, 499; (ZECCHINI and NUOLI), A., ii, 505.

peat, composition of various kinds of (TACKE and TOLLENS), A., ii, 682.

manuring experiments on (TACKE), A., ii, 42.

action of animal manure on (HELLSTRÖM), A., ii, 616.

vegetation experiments with (IMMENDORFF and TACKE), A., ii, 615.

composition of drainage from manured and unmanured (TACKE, IMMENDORFF, and MINSEN), A., ii, 683.

peat and sandy, impoverishment of, by removing turf and heather (IMMENDORFF), A., ii, 104.

sandy, action of burnt lime and marl on (TACKE, IMMENDORFF, SALFELD, and WOLFF), A., ii, 616.

of the Canton Redon, composition of (LECHARTIER), A., ii, 432, 433.

"alkali," in Montana (TRAPHAGEN and COBLEIGH), A., ii, 40.

Siberian arable, composition of (SEMPOLOWSKI), A., ii, 433.

of the Tokay wine district (v. BITTÓ), A., ii, 751.

methods of analysis. See Main Index.

NITRIFICATION, NITROGEN, and NITROGENOUS COMPOUNDS:—

Nitrification, recent researches on (WABINGTON), P., 1900, 65.

in the soil of forests (MIGULA), A., ii, 744.

of organic nitrogen (OMELIANSKY), A., ii, 97.

Nitrates, action of Bacteria on (GRIMBERT), A., ii, 97; (SEWERIN), A., ii, 232.

Nitrogen in soil, importance of various plants used for manuring in increasing the amount of (LARSEN), A., ii, 505.

atmospheric, assimilation of, by alinit Bacteria (STOKLASA), A., ii, 96.

AGRICULTURAL CHEMISTRY: SOILS:—

Alinit bacillus (KOLKWITZ), A., ii, 233.

Nitric organism from soil (STUTZER and HARTLEB), A., ii, 97.

Nitrifying organism, biology of a (BEYERINCK), A., ii, 425.

Nitrifying organisms, permanent forms of (BEDDIES), A., ii, 34. influence of organic substances on (WINOGRADSKY and OMELIANSKY), A., ii, 96.

magnesia-gypsum as a solid medium for the cultivation of (OMELIANSKY), A., ii, 232.

Denitrification and fermentation (WOLFF), A., ii, 298.

and decomposition of animal matters in soil (ROGÓYSKI), A., ii, 360.

Denitrifying organisms (GRIMBERT), A., ii, 97; (WOLFF), A., ii, 98; (SEWERIN), A., ii, 232.

morphology and biology of (JENSEN), A., ii, 495.

food of (STUTZER and HARTLEB), A., ii, 97, 359; (JENSEN), A., ii, 232;

(STUTZER and JENSEN), A., ii, 494. nutritive value of carbohydrates for (STOKLASA), A., ii, 98.

WATER.

Rain-water collected at Cirencester, amount of chlorine in (KINCH), T., 1271; P., 1900, 183.

MANURES AND MANURING EXPERIMENTS.

Manures, conservation of (SCHNEIDEWIND), A., ii, 105.

distribution of (BERTHAULT), A., ii, 753.

nitrogen value of (JOHNSON, JENKINS, and BRITTON), A., ii, 42.

denitrification and decomposition of (ROGÓYSKI), A., ii, 360.

effect of, on the inner processes of plants (MÜLLER-THURGAU), A., ii, 506.

animal, action of, on peat soil (HELLSTRÖM), A., ii, 616.

artificial, changes in the weight of, when exposed to air (V. WISELL), A., ii, 683.

use of, for forcing house-crops (JENKINS and BRITTON), A., ii, 365; (OTTO), A., ii, 753.

green, composition of, grown on peaty and sandy soils (IMMENDORFF), A., ii, 164.

methods of analysis. See Main Index.

Alinit, behaviour of (KRÜGER and SCHNEIDEWIND), A., ii, 164.

manurial effect of (CAMPBELL; v. FEILITZEN), A., ii, 433; (TACKER), A., ii, 434.

AGRICULTURAL CHEMISTRY: MANURES:—

Alinit, use of, in the cultivation of cereals (MALPEAUX), A., ii, 498.

Ammonium sulphate as a manure (KLÖPPER), A., ii, 616.

Bone-meal, influence of Bacteria on the decomposition of (STOKLASA, DUCHÁČEK, and PITRA), A., ii, 684.

Farmyard manure, methods of experiments on the preservation of (PFEIFFER, MOSZEIK, and LEMMERMANN), A., ii, 753.

composition of the gas confined in (DEHÉRAIN and DUPONT), A., ii, 617.

Fertiliser-nitrogen, availability of (JOHNSON, JENKINS and BRITTON), A., ii, 42, 506.

Guano, bat, from Cagliari, Sardinia (PARIS), A., ii, 106.

fish, experiments with (BAESSLER), A., ii, 308.

Kraal manure, composition of (LEWIS), A., ii, 507.

Lime and magnesia in burnt lime and marls, experiments with (ULBRICHT), A., ii, 240.

Burnt lime, action of, on sandy soil (TACKER, IMMENDORFF, SALFELD, and WOLFF), A., ii, 616.

Manure-soils from Bohemia composition of (KOURINSKY), A., ii, 752.

Marl, action of, on sandy soil (TACKER, IMMENDORFF, SALFELD, and WOLFF), A., ii, 616.

Nitragin, experiments with (FRANK), A., ii, 298; (NOBBE and HILTNER), A., ii, 299; (CAMPBELL), A., ii, 433; (ADLER), A., ii, 501; (DICKSON and MALPEAUX; SCHRIEBAUX), A., ii, 505; (STOKLASA; DAWSON), A., ii, 610.

Phosphates, infection of, and its prevention (BORNTÄGER), A., ii, 684.

experiments with (SCHREIBER; WAGNER), A., ii, 506, 507.

Tricalcium phosphate, solubility of, in natural waters in presence of carbonic acid (SCHLOSSING), A., ii, 541, 618.

Phosphatic manures, value of lime in (BÜTCHER), A., ii, 106.

Phosphoric acid, water-soluble, behaviour of, in soils (ULLMANN and GRIMM), A., ii, 431.

of basic slag and phosphates, solubility of, in peat soils, dependent on the amount of free humic acid in the soil (MINNSEN and TACKER), A., ii, 618.

AGRICULTURAL CHEMISTRY: MANURES:

Phosphoric acid, methods of analysis.

See Main Index.

Phosphorite, manuring experiments with (SEMPOLOWSKI), A., ii, 43.

Potash-lime manure, experiments with (BAESSLER), A., ii, 308.

Poultry manure, importance of (ULRICH), A., ii, 308.

Slag, basic, experiments with (SEMPOLOWSKI), A., ii, 43; (SCHREIBER; WAGNER), A., ii, 506, 507.

methods of analysis. See Main Index.

Sodium nitrate as a manure (KLÖPPER), A., ii, 616.

perchlorate in, injurious effect of, on the growth of sugar-beet (STOKLASA), A., ii, 305.

Sheep dung deposits, composition of (LEWIS), A., ii, 507.

Stable manure, loss of nitrogen in (MAERCKER and SCHNEIDEWIND), A., ii, 105.

storage of (HOLDEFLEISS), A., ii, 571.

Street-dust as manure (CASALI), A., ii, 754.

Superphosphate and basic slag, experiments with (BAESSLER), A., ii, 307.

reversion of soluble phosphoric acid in (SCHUCHT), A., ii, 44.

bone- and mineral-, comparison between (MENOZZI), A., ii, 43.

methods of analysis. See Main Index.

Manuring experiments on the Schultz-Lupitz system (BAESSLER), A., ii, 504.

with green and dead plants and parts of plants (WOOLNY), A., ii, 683.

Air. See Atmospheric air.

Albaspidin (HAUSMANN), A., i, 49.

Albito from Virginia (VIOLA), A., ii, 663.

Albumen of the seed of the American bean (*Gleditschia triacanthos*), composition of the (GORET), A., ii, 562. of St. Ignatius bean and Nux vomica, composition of the (BOURQUELOT and LAURENT), A., ii, 498, 611.

Albumin, formation and decomposition of, in plants (SCHULZE), A., ii, 612. in the cell of the queen bee (SÜSS; KLETT), A., ii, 93.

in ox-serum (HOUGARDY), A., i, 709.

in normal urine (BELLOCQ), A., ii, 556.

Bence-Jones, occurrence of, in urine (MAGNUS-LEVY), A., i, 615.

Albumin, action of heat, dilute acids and alcohol on (PANORMOFF), A., i, 127. formation of bases from (COHN), A., i, 466.

digestion of, by papain (HARLAY), A., i, 419.

detection of, in urine (MANKIEWICZ), A., ii, 459; (JOLLES), A., ii, 516.

error in estimating, in urine (DEROIDE and OUI), A., ii, 123.

Albumin, egg-, preparation of a pure (HOPKINS), A., i, 466.

crystalline, oxidation of, by hydrogen peroxide (SCHULZ), A., i, 266.

effect of desiccation on the coagulability of (FARMER), A., i, 572.

Albumins, egg-, nomenclature of (PANORMOFF), A., i, 126.

Albuminuria, origin of the proteids in (CLOËTTA), A., ii, 155.

Albumin, action of heat, dilute acids, and alcohol on (PANORMOFF), A., i, 571.

Albuminoid. See Proteid.

Albumoses, formation of (BOKORNY), A., i, 126.

amount of nitrogen from (FRIEDMANN), A., i, 265.

influence of, on urinary secretion (THOMPSON), A., ii, 226.

detection of, in urine (V. ALDOE), A., ii, 123.

Alkali-albumose, from the action of alkali on proteid (MAAS), A., i, 709.

Hetero-albumose from fibrin, nutritive value of (BLUM), A., ii, 667.

Proto-albumose from casein, nutritive value of (BLUM), A., ii, 667.

Hetero- and Proto-albumoses, composition of (PICK), A., i, 68.

Alcohol. See Ethyl alcohol.

Alcohol (b. p. 83-84°), from the hydrocarbon from isofenchyl alcohol (BERTRAM and HELLE), A., i, 399.

pentahydric, from methylallylcarbinol, and its acetyl derivatives (MAXIMOVITSCH), A., i, 325.

C₅H₁₀O, from isoprene bromide (MOKIEWSKY), A., i, 509.

Alcoholism, acute, estimation of in blood and tissues in (GREEN), A., ii, 95, 112.

Alcohols, synthesis of (GRIGNARD), A., i, 382.

magnetic behaviour of (HEINRICH), A., ii, 707.

acidity of (DE FORCAND), A., ii, 527.

reaction of, with alkyl nitrites, in presence of excess of alcoholic hydrogen chloride (KISSEL), A., i, 520.

Alcohols, action of aluminium amalgam on (TISTSCHENKO), A., i, 269.
determination of the toxicity of (VANDEVELDE), A., ii, 302.
detection of aldehydes in (ISTRATI), A., ii, 117.
detection of methyl alcohol in (WOLFF), A., ii, 111.
estimation of, in brandy (ADAM), A., ii, 53.

Alcohols and Phenols. See also :—

p-Acetoxy- ψ -cumyl alcohol.
p-Acetylamino benzoylcarbinol.
7-Acetylamino-2-naphthol.
Acetylcarbinol.
Alcornol.
Allyl alcohol.
Amyl alcohol.
Amyrol.
Anhydro-*p*-acetylamino benzyl alcohol.
Anhydro-*p*-formylamino benzyl alcohol.
p-Anhydromethylamino benzyl alcohol.
Anthragallol.
Apigenin.
Aspidinol.
Benzeneazo- α -*ds*bromophenol.
Benzeneazo- β -naphthol.
Benzeneazophenol.
Benzenyl- α -aminophenol.
Benzoylbenzhydrol.
Benzoylcarbinol.
Benzyl alcohol.
Benzylcarbinol.
Benzyl dimethylcarbinol.
Benzyl dimethylolquinaldine.
Benzylidenebis dihydroresorcinol.
Benzylidenebis dimethyl dihydroresorcinol.
Benzylidenebis diphenyl dihydroresorcinol.
Benzylmethylolquinaldine.
Borneols.
p-sec. Butylphenol.
Carvacrol.
Carvomenthol.
Catechol.
Cholesterol.
Citronallol.
Coprosterol.
Cresols.
Cumenol.
Dibenzylidenebis dimethyl dihydroresorcinol.
Diacetylamino- β -naphthol.
Diethyl α -aminocresol.
Dihydrocarveol.
Dihydrocumyl alcohol.
Dihydroeucarveol.
Dihydroresorcinol.
Dihydroxy crackene.
Dihydroxy dimethylpropanes.
2:5-Dihydroxydiphenyl.

Alcohols and Phenols. See :—

Dihydroxyflavones.
Dihydroxynaphthalenes.
Dihydroxynaphththaquinone.
Dihydroxy- α -xylene.
Dihydroxyxyloquinone.
Dimethylallylcarbinol.
 α -Dimethylanthranol.
Dimethylol-5-methylacridine.
Dimethyl-1:2:3:5-phenetrol.
Dimethylphloroglucinol.
Dimethylpropan-1:3-diols.
2:6-Diphenylphenol.
Diphenylquinol.
Dulcitol.
Erythritols.
Ethyl alcohol.
Ethylene glycol.
Ethylphloroglucinol.
Fenchyl alcohols.
 α -Formylamino phenol.
 γ -Furfuryl- $\beta\beta$ -dimethylpropylene glycol.
Geraniol.
Glycerol.
Guaiacol.
Hydroxybenzyl alcohols.
Hydroxy- ψ -cumyl alcohols.
p-Hydroxy- ψ -cumylene α -glycol.
8-Hydroxy-5:7-dimethylfluorone.
2-Hydroxydiphenyl.
Hydroxydiphenylbenzene.
5-Hydroxyhydrindene.
4-Hydroxymesityl alcohol.
3-Hydroxy-5-methoxy-2-methylphenol.
3-Hydroxy-5-methoxy-2-methyl-*p*-quinol.
7-Hydroxy-2-methylchromone.
2-Hydroxy-3-methyldiphenyl.
8-Hydroxymethylfluorone.
Hydroxynaphthaquinones.
Hydroxyphenanthrenes.
Hydroxyphenylcoumalin.
Hydroxystyrogallol.
Hydroxyxylylene glycols.
Iditols.
Inositol.
Iretol.
Iariciresinols.
d-Mannitol.
Menthol.
Menthomenthol.
Meitol.
 α -Methoxybenzyl alcohol.
 α -Methoxyphenyl-*di*- and -*tri*-chloromethylcarbinols.
Methylacetalylquinol.
Methylacetalylresorcinol.
Methylacetylcarbinol.
Methyl alcohol.
Methyl- α -aminophenol.

Alcohols and Phenols. See :—

Methylallylcarbinol.
 Methylenebisdihydroresorcinol.
 Methylenebisdimethyldihydroresorcinol.
 Methylenebisdiphenyldihydroresorcinol.
 Methylenebismethyldihydroresorcinol.
 Methylenebisphenyldihydroresorcinol.
*iso*Methyleugenol. •
 Methylcyclohexanols.
 Methyloctadienol.
o-Methylolbenzoic hydrazide.
 Methyloldeoxycinchonine.
 Methyloldoxycinchinine.
 Methylol-5-ethylacridine.
 Methylol-5-methylacridine.
 2-Methyl-1 : 3 : 4 : 5-phentetrol.
 Methylphloroglucinol.
 Morphenol.
 Morphol.
 α -Naphthaquinone-3-dihydroresorcinol.
 Naphthols.
 Orcinol.
 Oxymesitol.
 Oxyxlenol.
 Pentaglycols.
 Pentamethylbenzhydrol.
 Phenol.
 Phenolazobenzeneazophenol.
 Phenols.
 Phentetrol.
 Phenylisobutylcarbinol.
 Phenyltrimethylcarbinol.
 Phenyl-3 : 3-dimethyl-2-indolinol.
 Phenylethyl alcohol.
 Phenylmethylacridol.
 2-Phenylphenol.
 Phloroglucinol.
 Phytosterol.
 Picric acid.
 Pinenol.
 Propionylcarbinol.
 Propylcatechol.
 Propylene glycol.
 Quinol.
 Quinolinephenol.
 Resorcinol.
 Rhodinol.
 Sabinene glycol.
 Sabinol.
 Sabinylglycerol.
 Santalols.
 Sorbitols.
 Sphagnol.
 Styryl-trichloromethylcarbinol.
 Tanacetyl alcohol.
 Tetrahydroxyanthraquinone.
 Tetrahydroxytoluene.
 Tetramethyldiaminobenzhydrol.
 Tetramethyldiaminophenylcarbinol.

Alcohols and Phenols. See :—

Tetramethyldiaminophenylmethylcarbinol.
 Thebaols.
 Thujol.
 Thymol.
 Toluquinol.
 2 : 3 : 6-Trihydroxyanthracoumarin.
 1 : 2 : 3-Trihydroxyanthraquinone.
 Trihydroxyflavones.
 1 : 2 : 4-Trihydroxynaphthalene.
 Trihydroxynaphthaquinones.
 Trihydroxytoluene.
 Trimethyldihydroresorcinol.
 Trimethyldihydroxybenzenes.
 Trimethylphloroglucinol.
 Trisdihydroxybenzoylenebenzene.
 Xylenols.
Alcornol, $C_{22}H_{34}O$, from alcornoco barks (HARTWICH and DÜNNENBERGER), A., ii, 747.
Aldazines, preparation of (CURTIUS and LUBLIN), A., i, 700 ; (CURTIUS), A., i, 701.
 reduction of (CURTIUS), A., i, 610.
Aldehydase from the liver and suprarenal capsule (JACOBY), A., i, 711.
Aldehyde. See Acetaldehyde.
Aldehyde, $C_{10}H_{12}O_2$, from the oxidation of anethole (BOUGAULT), A., i, 495.
Aldehyde group, $R \cdot CH_2$, replacement of, by benzoyl, in hydrazine derivatives (MINUNNI and CARTA-SATTA), A., i, 251.
Aldehyde-musk, its oximes and diacetyl derivative (BAUR-THURGAU and BISCHLER), A., i, 178.
Aldehydes, condensation of, with secondary bases and dithio-oxamide (WALLACH), A., i, 210.
 condensation of, with chrysean (HELLSING), A., i, 518.
 compounds of, with isocyanides (WADE), P., 1900, 157.
 compounds of, with dihydroresorcinol (VORLÄNDER and KALKOW), A., i, 99 ; (VORLÄNDER and STRAUSS), A., i, 100.
 action of, on phenylacetic acid, and on phenylacetonitrile and its derivatives (v. WALTHER and WETZELICH), A., i, 438.
 action of, on quinoline derivatives containing a methyl or methylene group in 2 or 4 positions (KOENIGS), A., i, 189.
 detection of (LEWIN), A., ii, 179.
 detection of, in alcohols (ISTRATI), A., ii, 117.
 estimation of, by means of hydrazines (HANUS), A., ii, 773.

Aldehydes, aromatic, preparation of, from the corresponding acids by means of hydrazines (CURTIUS), A., i, 701.

condensation of, with azodicarbamide (YOUNG and WITHAM), T., 224; P., 1900, 5.

compounds of, with secondary hydrazines (LABHARDT and v. ZEMBRUSKI), A., i, 125.

action of, on derivatives of β -naphthylamine (MORGAN), T., 1210; P., 1900, 171.

double compounds of, with orthophosphoric acid (RAIKOW), A., i, 602.

reaction between sodium borneols and (HALLER), A., i, 301.

Aldehydes, polymeric, action of bromine on (FRANKE), A., i, 427.

Aldehydes. See also:—

Acetaldehyde.

Acraldehyde.

Aldehyde-musk.

Aldols.

Anisaldehyde.

Benzaldehyde.

Benzeneazosalicylaldehyde.

Bromal.

*iso*Butaldehyde.

Butylxylylaldehyde.

Camphenilanaldehyde.

Carvacrylacetalddehyde.

Chloral.

Citral.

Citronellal.

Formaldehyde.

Furfuraldehyde.

Glycollic aldehyde.

Glyoxal.

p-Hydroxybenzaldehyde.

2-Hydroxy-4:5-dimethylbenzaldehyde.

o-Hydroxymandelic aldehyde.

p-Hydroxymesitylenealdehyde.

p-Hydroxyphthalaldehyde.

Hydroxy-*o*-tolualdehydes.

Malonic acid, semi-aldehyde of.

Methoxyhydratropic aldehyde.

Methylfurfuraldehyde.

Nonaldehyde.

Paraformaldehyde.

α -Phenoxypropaldehyde.

Propaldehyde and Parapropaldehyde.

p-*iso*Propylphenoxyacetaldehyde.

Pyrrole-2-aldehyde.

4-Quinolinaldehyde.

Rhodinal.

Salicylaldehyde.

Santalal.

Terephthalaldehyde.

Triacetaldehydes.

Tolyloxypropaldehyde.

Aldehydes. See:—

Valeraldehyde.

Vanillin.

Xylenoxyaldehyde.

o-Aldehydic acids, condensation products of, with ketones, properties of (FULDA), A., i, 86.

Aldehyde-*o*-aminobenzoic acid, phenylhydrazine and semicarbazone of (ELLIOTT), T., 214; P., 1899, 243.

p-Aldehydobenzamide (MOSES), A., i, 659.

Aldehydophenoxyacetic acid, bromo- and chloro- (STOERMER), A., i, 654.

Aldol from isobutaldehyde and formaldehyde, and its triacetyl derivative (WESSELY), A., i, 428.

OH·CHMe·CHMe·CHO, from the condensation of acetaldehyde and propaldehyde (SCHMALZHOFFER), A., i, 626.

Aldols, molecular weight of the (KOHN), A., i, 274.

Alga, green, pure culture of a (RADAIS), A., ii, 362.

Algæ, marine, composition of (CUNIASSE), A., ii, 680.

Alinit. See Agricultural Chemistry.

Alizarin-green-B as an indicator (FORMANEK), A., ii, 435.

Alkali, estimation of free, in soaps (DIVINE), A., ii, 759.

Alkali carbonates, estimation of, in presence of alkali hydrogen carbonates (CAMERON), A., ii, 575.

percarbonates and persulphates, iodometric estimation of (RUPP), A., ii, 572.

chlorides, electrolysis of solutions of (FOERSTER), A., ii, 72, 400; (MÜLLER), A., ii, 73; (BROCHET), A., ii, 205, 276, 541; (WOHLWILL), A., ii, 400, 471; (SIEVERTS), A., ii, 470; (LORENZ and WEHRLIN), A., ii, 476.

electrolysis of solutions of, with a diaphragm (FOERSTER and JORRE), A., ii, 343.

electrolysis of solutions of, evolution of oxygen at the anode in the (FOERSTER and SONNEBORN), A., ii, 645.

hydroxides, heat of formation of (DE FORCRAND), A., ii, 476.

action of, on nitrogen iodide (CHATTAWAY and ORTON), A., ii, 722.

iodides, action of oxidising agents on (PÉCHARD), A., ii, 536.

metals, preparation of alloys of (LEBEAU), A., ii, 276.

nitrites, colour of (DIVERS), P., 1900, 40.

persulphates, estimation of (GRÜTZNER), A., ii, 310.

Alkali-albumose. See Albumose.

Alkalimetry (ASTRUC), A., ii, 572.

of the amines (ASTRUC), A., i, 141.
perezone as an indicator in (DUYK), A., ii, 308.

Alkaline earth carbonates, solubility of, in water containing carbon dioxide (BODLANDER), A., ii, 715.

metals, electrolysis of the bromides of (SARGHEL), A., ii, 400.

metals, toxic action of compounds of the, towards the higher plants (COUPIN), A., ii, 363; (SUZUKI), A., ii, 561.

Alkalies, action of iodine on (TAYLOR), T., 725; P., 1900, 70.

Alkali-syenite (*umpekteite*) from Massachusetts (WRIGHT), A., ii, 663.

Alkaloid, C₈H₇ON, from pomegranate root (PICCININI), A., i, 110.

from the balsam of *Abies canadensis* (TSCHIRCH and BRÜNING), A., i, 679.

from the balsam of *Abies pectinata* (TSCHIRCH and WEIGEL), A., i, 680.

from *Agaricus phalloides* (KOBERT), A., ii, 156.

from the balsam of *Larix decidua* (TSCHIRCH and WEIGEL), A., i, 680.

Alkaloids of Japanese aconite and of *Aconitum Napellus*, comparison of properties of (DUNSTAN and READ), T., 63.

of *Bocconia cordata* (MURRILL and SCHLOTTERBECK), A., i, 686.

poisonous, of the Boraginæ (GREIMER), A., i, 683.

of *Ceanothus americanus* (GORDIN), A., i, 683.

distribution of, in the Compositæ (GRASHOFF), A., i, 556.

of the leaves of *Datura Stramonium*, *Hyoscyamus niger*, and *Atropa Belladonna*, estimation of (SCHMIDT), A., ii, 379.

of jaborandi leaves (JOWETT), T., 473; P., 1900, 49.

from the seeds of blue and perennial lupins (CALLSEN), A., i, 186.

percentage of, from various lupins (SEMPOLOWSKI), A., ii, 103.

amount of, in the bark of Java pomegranates, and titration of (BECK-URTS), A., ii, 563.

from the salamander (FAUST), A., i, 186.

of the Solanacæ (HESSE), A., i, 50; (GADAMER), A., i, 356.

alkylated, relationship between the chemical constitution and physiological action of (ROSENSTEIN), A., ii, 294.

Alkaloids, action of formaldehyde on (KOENIGS), A., i, 190.

combination of, with nucleins (STASANO), A., ii, 559.

action of chloroform or ether on salts of (HILL; SCHAER), A., ii, 455.

alkylthiosulphonates of (TROEGER and LINDE), A., i, 515.

use of chloral hydrate in the estimation of (SCHAER), A., ii, 57.

alkalimetric method for the estimation of (GORDIN), A., ii, 777.

estimation of, volumetrically (LINDE), A., ii, 583.

estimation of, by iodine solution (KIP-PENBERGER), A., ii, 583; (SCHOLTZ), A., ii, 638.

salt forming, estimation of (GORDIN), A., ii, 119.

vegetable, estimation of, volumetrically, by titration with acids (KIP-PENBERGER), A., ii, 637.

Alkaloids. See also Ptomaine.

Alkaloids. See also :—

Aconitine.

Anagyryne.

Arginine.

Atropine.

Atroscine.

Berberine.

Butyleytisine.

Caffeine.

Carnosine.

Carpaine.

Cetyleytisine.

Cheirinine.

Chelerythrine.

Choline.

apo-Cinchenine.

Cinchonidine.

Cinchonine.

Cocaine.

Codeine.

Coniine.

Consolicine.

Cornutine.

Cotarnine.

ψ-Cotarnine.

Creatine.

Creatinine.

Cynoglossine.

Cytisine.

Damascenine.

Deoxycaffeine.

Deoxymorphine.

Deoxytheobromine.

Dihydrocinchenine.

Ecgonines.

Echinopsine.

Epinephrine.

Ethyleytisine.

Guanine.

Alkaloids. See:—

Histidine.
 β -Homochelidonine.
 Homocapocinchénine.
 Hydroxyapocinchénine.
 Hyosine.
 Hyoscyamine.
 Jaborine.
 Japaconine.
 Japaconitine.
 Japbenzaconine.
 Ketoapocinchénine.
 Ketohomocapocinchénine.
 Laudanosine.
 Lysine.
 Macleyine (*protopine*).
*iso*Meroquinénine.
 Methyleytisine.
 Methyljapaconitine.
 Methylmorphimethine.
 Methylphenomorpholine.
 Methylisopilocarpine.
 Morphine and *iso*Morphine.
 Narceine.
 Narcotine.
 Nicotine.
 Nortropidine.
 Oxycotarnine.
 Paraxanthine.
 Pilocarpidine.
 Pilocarpine and *iso*Pilocarpine.
 Protopine.
 Protoveratrine.
 Pyrojapaconine.
 Pyrojapaconitine.
 Ricinine.
 Samadaridine.
 Samadarine.
 Scopolamine.
 Solanine.
 Spingosine.
 Strychnine.
 Suprarenine.
 Symphytocynoglossine.
 Theobromine.
 Tropine and ψ -Tropine.
 Veratrine.
 Xanthine.
Alkaramel, (SCHWEITZER), A., i, 277.
Alkyl bromides, velocity of combination of secondary amines with (MEN-SCHUTKIN), A., i, 335, 341.
 haloids, nitrates, and sulphates, dissociation of (NEF), A., i, 4, 349.
 iodides and dry silver oxide, alkylation by means of (LANDER), T., 736; P., 1900, 6, 90.
 action of, on acylthioncarbamie esters (WHEELER and JOHNSON), A., i, 632.

Alkyl iodides, action of, on mercuric iodide-sulphides of the fatty series (SMILES), T., 160; P., 1899, 240.
 compounds of, with isocyanides (WADE), P., 1900, 157.
 nitrates, decomposition of, by alkalis (BERTHELOT), A., i, 620.
 nitrites, reaction of, with alcohols and ketones in presence of excess of alcoholic hydrogen chloride (KISSEL), A., i, 620.
 action of zinc alkyls on (BEWAD), A., i, 629.
 phosphates (CAVALIER), A., i, 75; (CAVALIER and PROST), A., i, 579.
Alkylation by means of dimethyl sulphate (ULLMANN and WENNER), A., i, 619.
 by means of dry silver oxide and alkyl haloids (LANDER), T., 729; P., 1900, 6, 90.
 of ketones (NEF), A., i, 349.
Alkyldicarboxylic acids, method of identifying, and their amic acids and imides (AUWERS, MAYER, and SCHLEICHER), A., i, 84.
Alkylloxides, additive compounds of, with nitro-compounds (HANTZSCH and KISSEL), A., i, 89; (JACKSON and GAZZOLO), A., i, 433; (ANGELI), A., i, 553.
 aluminium (TISTSCHENKO), A., i, 269.
 sodium, action of, on ethyl phthalyl-aminosacetate and its homologues (GABRIEL and COLMAN), A., i, 358.
 β -Alkyl-oxy- α -cyanocrotonic acids, ethyl esters of, isomeric with ethyl cyano-alkylacetates, preparation of (HALLER), A., i, 872.
 β -Alkyl-oxy- β -phenyl- and - β -benzyl-acrylic acids, α -cyano-, alkyl esters and action of ammonia on (HALLER and BLANC), A., i, 496.
Alkylquinoline salts, nitration of (DECKER), A., i, 689.
Alkylurethanes, nitroso- (HANTZSCH), A., i, 86; (BRÜHL), A., i, 210.
Allantoin, estimation of, in urine (LOEWI; PODUSCHKA), A., ii, 636.
Allenemercury salts (SAND and HOFMANN), A., i, 386; (HOFMANN and SAND), A., i, 618.
Allophane from Italy (D'ACHIARDI), A., ii, 218.
Alloxuric substances in the urine in nephritis (MARTIN), A., ii, 155.
Alloys, heat of formation of (TAYLER; GLADSTONE), A., ii, 710.
 specific heat of, at low temperatures (BEHN), A., ii, 259.

- Alloys**, thermo-electrical properties of (STEINMANN), A., ii, 523, 524.
 application of the phase rule to (LE CHATELIER), A., ii, 197.
 metallic, direct combustion of (BREARLEY), A., ii, 440.
 separation in (NANNES), A., ii, 581.
 estimation of arsenic in (HOLLARD and BERTIAUX), A., ii, 438.
- Allyl alcohol**, hydrogenation of (SPERANSKI), A., i, 3.
 action of, on mercuric salts (SAND and HOFMANN), A., i, 386; (BIILMANN), A., i, 431; (HOFMANN and SAND), A., i, 618.
 action of potassium platinochloride on (BIILMANN), A., i, 543.
 preparation of acrylic acid from (BIILMANN), A., i, 425.
- Allylacetone** and its oxime, semicarbazone and dibromide (v. BRAUN and STECHELE), A., i, 429.
- Allylene**, action of hypochlorous and hypobromous acids on (WITTORF), A., i, 421.
- Allylmaleonic acids**, substituted, ethyl esters of, action of nitrosyl chloride on (IPATIEFF), A., i, 15.
- Allyloxide**, aluminium, preparation of (TISTSCHENKO), A., i, 270.
- Allyloxidemercuric salts** (BIILMANN), A., i, 431.
- Aloin reactions**, nature of Klunge's, and production of "aloin red" (SCHAER), A., i, 512; ii, 583.
- Aluminium**, some properties of (MATIGNON), A., ii, 482.
 transparency of, to radium radiations (BECQUEREL), A., ii, 381, 518.
 action of caustic hydroxides on (ALLEN and ROGERS), A., ii, 727.
- Aluminium compound** formed at the aluminium anode in the electrolysis of sulphuric acid (NORDEN), A., ii, 404; (MORGAN and DUFF), A., ii, 588.
- Aluminium alloys** with gold (HEYCOCK and NEVILLE), A., ii, 549.
 with mercury, action of, on alcohols (TISTSCHENKO), A., i, 269.
- Aluminiumarsenide**, phosphide, selenide, and sulphide, preparation of (FONZES-DIACON), A., ii, 405; (MATIGNON), A., ii, 482.
 bromide, bromination with, in the fatty series (POURET), A., i, 369.
 compounds of, with bromo-derivatives of ethane and carbon disulphide (KONOWALOFF and PLOTNIKOFF), A., i, 323.
 chloride, function of, in the Friedel-Crafts' reaction (PERRIER), A., i, 331; (BOESEKEN), A., i, 349.
- Aluminium chloride**, anhydrous, action of, on acetylene (BAUD), A., i, 369.
 action of, on camphoric anhydride (LEES and PERKIN), P., 1900, 18; (BLANC), A., i, 133, 586.
 additive compounds of, with benzoic chloride and benzophenone (KRONBERG), A., i, 502.
 fluoride, double salts with cobalt, copper, ferrous, nickel or zinc fluoride (WEINLAND and KÖPPEN), A., ii, 144.
 hydroxides (ALLEN), A., ii, 726.
 nitride, formation of, in the electric arc (ARONS), A., ii, 143.
 oxide (*alumina*), new hydrate of, (ZUNINO), A., ii, 348.
- Aluminium organic compounds**:—
- Aluminium alkyloxides** (TISTSCHENKO), A., i, 269.
- Aluminium, estimation of**:—
 estimation of (STOCK), A., ii, 247, 315; (ALLEN and GOTTSCHALK), A., ii, 762.
 estimation of, by solution in hydrochloric acid (BALDY), A., ii, 690.
 estimation of, in presence of calcium, iron, magnesium and manganese (HESS and CAMPBELL), A., ii, 50.
 estimation of, as phosphate in ore and blast-furnace cinder (CAMP), A., ii, 763.
 estimation of, in natural phosphates (VEITCH), A., ii, 577.
- Amalgams**. See Mercury alloys.
- Ananin muscaria*, green pigment of (GRIFFITHS), A., ii, 235.
- Amarine and isomarine**, constitution of (JAPP and MOIR), T., 608; P., 1899, 211, 227; 1900, 15.
- Amarine**, racemic and optically active forms of (SNAPE), T., 778; P., 1899, 228; 1900, 118.
- Ambrite**, from New Zealand coal (BEDSON), A., ii, 20.
- Amethyst**, colour of (NABL), A., ii, 661.
- Amides**, action of dry silver oxide and alkyl iodides on (LANDER), T., 736; P., 1900, 6, 90.
 formation of the sodium salts of (WHEELER), A., i, 492.
- Amidines**, action of, on mesityl oxide and phorone (TRAUBE and LORENZ), A., i, 116.
- Amidosulphite**, formation and decomposition of (DIVERS and OGAWA), T., 327; P., 1900, 38.
- Amidosulphuric acid**, production of (DIVERS and HAGA), T., 978; P., 1900, 147.

Amine nitrates, dehydration of, to nitramines (*diazotic acids*) (BAMBERGER and HOFF), A., i, 435.

Amines in aqueous solutions, molecular dissociation of (HANTZSCH and SEBALDT), A., ii, 69.

alkalimetry of the (ASTRUO), A., i, 141.

oxidation of, by Caro's reagent (BAMBERGER and HILL), A., i, 281; (BAMBERGER), A., i, 500.

action of, on acylthioncarbamate esters (WHEELER and JOHNSON), A., i, 632.

action of, on hydroxamic acids (THIELE and PICKARD), A., i, 29.

condensation of, with salol (COHN), A., i, 548.

bromo-, action of silver oxide and of hydroxylamine on (KIJNER), A., i, 277, 338, 629.

Amines, aromatic, direct introduction of nitro-groups into the side chain of (BAMBERGER and HOFF), A., i, 435.

action of cyanogen on (MEVES), A., i, 483.

action of phosphoryl chloride, and of phosphorus thiochloride on, in presence of alkali (AUTENRIETH and RUDOLPH), A., i, 570.

action of picryl chloride on (WEDEKIND), A., i, 216.

primary aromatic, action of hypochlorous acid on (MEIGEN and NORMANN), A., i, 702.

action of nitrous acid on (TÄUBER and WALDER), A., i, 566.

tertiary aromatic (HÄUSSERMANN), A., i, 365.

aromatic and fatty, compounds of, with tellurium tetrabromide and tetrachloride (LENHER), A., i, 379.

fatty, action of Caro's reagent on (BAMBERGER and HILL), A., i, 281.

action of hydrogen peroxide on (MAMLOCK and WOLFFENSTEIN), A., i, 209.

action of sulphur dioxide on (SCHUMANN), A., ii, 272.

detection of (RIMINI), A., ii, 56, 454.

primary and secondary, acetylation of (MUSSELIUS), A., i, 334; (MENSCHUTKIN), A., i, 335, 341.

secondary, new synthesis of (TINGLE), A., i, 641.

velocity of combination of alkyl bromides with (MENSCHUTKIN), A., i, 335, 341.

condensation of, with aldehydes and dithio-oxamide (WALLACH), A., i, 210.

Amines, tertiary, action of cyanogen bromide on (v. BRAUN), A., i, 430, 541, 687.

action of hypochlorous acid on (WILLTÄTTER and IGLAUER), A., i, 458.

primary, secondary and tertiary, distinguishing (SOLONINA), A., i, 147; (MARCKWALD), A., i, 149, 336; (DUDEN), A., i, 282; (MENSCHUTKIN), A., i, 335.

action of, on dibromotriacetoneamine (PAULY and BOEHM), A., i, 357.

compounds of, with iminothiodiphenylimine (SCHAPOSCHNIKOFF), A., i, 523.

Amines. See also:—

Acetylaniline.

Acetyl- ψ -cumidine.

Acetylguanidine.

Acetyloulidines.

Acetyl-*as-m*-xylydine.

Anhydrotriacetonediguanidine.

Aniline.

Anilindiphenylguanidine.

7-Anilino-3:4-diphenyltriazole.

Anilino-4-methylpyrimidine, amino-

5-Anilino-4-phenyltriazole.

Ansidine.

Auramine.

Benzamidine.

Benzidine.

β -Benzylallylamine.

Benzylisocamylamine.

Benzylaniline.

Benzylbutylamines.

Benzylidguanide.

α -Benzylhydroxylamine.

Benzylideneaminodiphenylguanidine.

Benzylideneaminoditolylguanidines.

Benzylideneaniline.

Benzylidene-2-naphthylamine.

Benzylideneneobornylamine.

Benzylphenylnitrosamine.

Bornylamine.

β -Bornylhydroxylamine.

Butylxyldines.

p-n-Butyrylaniline.

Butyryl-*o*-flavaniline.

2-Camphanamine.

Camphenamine.

Campholene, α -amino-

Carbanilinoamino-diphenyl- and -ditolyl-guanidines.

Catecholcarbonylbisamylamine.

Chitosamine (*glucosamine*).

Cinnamylidene-2-naphthylamine.

Cinnamylidene-2-naphthylamine.

Diacetoneamine.

Diisocamylbromamine.

Dianiline.

Dianilinoquinoneanil.

Amines. See:—

Dibenzylamine.
s-Dibenzyl-*i*-diphenylethylenediamine.
 Dibenzyl- β -naphthylamine.
 Di-2:4-dimethylbenzylamine.
p-Diethylaminobenzyl-*p*-toluidine.
 2:2'-Diethyldiamino-1:1'-dinaphthylmethane.
 Diethylaniline.
 Diethylenediamine.
 Diethylhydroxylamine.
 Diethylnaphthylamines.
 Diethyltetrahydronaphthylamine.
 Dihydroiselaunonamines.
 Dihydroxypyrimidine, amino-.
 Dimenthylamine.
 Dimethylamine.
 Dimethylaminobenzyl-*p*-toluidine.
 4'-Dimethylaminodiphenylmethane, amino-.
 4-Dimethylaminophenylaminotolylmethanes.
 Dimethylaniline.
 Di-*p*-methylbenzylamine.
 Dimethylnaphthylamines.
 Dimethylphenonaphthacridine salts, amino-.
 2:6-Dimethylpyridine, 3:5-diamino-.
as-Dimethylthionine.
 Dimethylxylidines.
 α -Dinaphthylbenzidine.
 Dinaphthylphenylenediamines.
 Dioctylamine.
 2:6-Dioxy-4-methylpurine, 7-amino-.
 Diphenylamine, triamino-.
 Diphenylbutenylamidine.
 Diphenylethylenediamine.
 Diphenylguanidine, amino-.
 Diphenylmethane, tetramino-.
 Diphenylmethylenedihydroxylamine.
 Dipropylhydroxylamines.
 Ditolyethylenediamines.
 Ditolylguanidines, amino-.
 Di-*m*-tolylmethane, triamino-.
 Ditolylmethylenedihydroxylamine.
 Dixenylamine, diamino-.
 Di-*p*-xyl-*o*-methylenedihydroxylamine.
 Ethenyltriaminonaphthalene.
 Ethylamine.
 β -Ethyl-*sec*- and -*tert*-amylhydroxylamines.
 Ethylbenzene, amino-.
 β -Ethyl-*sec*. butylhydroxylamine.
 Ethyldichloroamine.
 Ethyleycanoaniline.
 Ethylenediamine.
 Ethylenetrimethylenediamine.
 β -Ethyl-*sec*. heptylhydroxylamine.
 Ethyl- β -naphthylamine.
 Ethylisopropylaniline.

Amines. See:—

β -Ethylpropylhydroxylamine.
 o -Flavaniline.
 Flavinduline, 2:7-diamino-.
 Flavindulines, amino-.
 Furfurine.
 Galactosamine.
 Glucosamine (*chitosamine*).
 Guanidine.
 Heptylamines.
 β -*tert*. Heptylhydroxylamine.
 Hexamethylenetetramine.
 Hexethylidenetetramine.
 Hexylamines.
 Homodihydroiselaunonamine.
 Hydrindamine.
 Hydroxybenzylaniline.
 Hydroxybenzylideneaminodi-*p*-tolylguanidine.
 Hydroxybenzylideneaniline.
 Hydroxybenzylidene-2-naphthylamine.
 o -Hydroxybenzyl-*p*-tolylnitrosoamine.
 2-Hydroxydiphenyl, 5-amino-.
 2-Hydroxy-1:3-diphenylbenzene, 5-amino-.
 Hydroxylamine.
 1-Hydroxylaminocamphane.
p-Hydroxymesitylaniline.
 Hydroxypyrimidine, amino-.
 Menthylamines.
 Mesidine.
p-Methoxybenzylidene-2-naphthylamine.
 3-*p*-Methoxyphenylquinoline, 2-amino-.
 Methylallylaniline.
 Methylamine.
 Methylaniline.
 Methyl-*o*-anisidine.
 Methylcyanoaniline.
 Methylenebis-2-naphthylamine.
 Methylene-glutamine.
 Methyl-ethylphenonaphthacridine, amino-.
 2-Methyl- α -naphthimidazole, amino-.
 Methyl-nitramine.
 Methylphenonaphthacridine, amino-.
m-Methylphenylethylamine.
 Methylisopropylaniline.
 4-Methylpyrimidine, amino-.
 Naphthaphenazine, 9-amino-.
 Naphthylamine.
 Naphthylene-*o*-diamines.
 Naphthyl-nitrosoamine.
 Naphthylphenylenediamine.
 Neobornylamine.
 β -Octylamine.
 Phenothiazine, 3:5-diamino-.
 Phenoxazine, diamino-.
 Phenylacetyleneaniline.
 Phenylamino-*m*-tolylmethanes.

Amines. See:—

Phenylbenzothiazole, amino-.
 Phenyl*tert.* butylamine.
 Phenylcamphorformeneamine.
m-Phenylenediamine.
 Phenylguanidine, amino-.
 Phenylhydrazonocarbo*di-p*-tolylamine.
 Phenylmethylnitrosoamine.
 2-Phenyl-4-methylquinoline, 6-amino-.
 2-Phenylnaphthalene, 2'-amino-.
 3-Phenylquinoline, 2-amino-.
 Phenylthionine.
 1-Phenyl-4:4:6-trimethyldihydropyrimidine, 2-amino-.
 Picrylnaphthylamines.
p-Propionylaniline.
 Propionyl-*o*-flavaniline.
*iso*Propylallylaniline.
*iso*Propylamine.
β-Propyl*sec.* amylhydroxylamine.
 Propyl*isobutyl*amine.
β-Propyl-*sec.*- and -*tert.*-hexylhydroxylamines.
 Propyl*isopropyl*aniline.
 Quinoline, 6-amino-.
 Silicotriphenylguanidine.
 Tetra-aniline.
 2:2'-Tetrabenzyl*di*amino-1:1-di-naphthylmethane.
 2:2'-Tetraethyl*di*amino-1:1-dinaphthylmethane.
d-ac-Tetrahydro-*β*-naphthylamine.
 Tetramethyl*di*aminodinaphthylmethanes.
as-Tetramethyl*di*aminodiphenylethane.
 Tetraphenylamine, *di*amino-.
 Tetraphenylguanidine.
 Tetraphenyl-*o*-phenylenediamine.
 Tolidine.
 Toluidines.
 Tolyldiguanides.
 Tolylenediamines.
 3-Tolyl-4'-hydroxyphenylamine.
 Tolylnaphthylamine.
o-Tolythionine.
 Triacetoneamine.
 Trianiline.
 Tribenzylamine.
 Triethylamine.
 Triethylenediamine.
 Trimethylamine.
 4:4:6-Trimethyldihydropyrimidine, 2-amino-.
 Trimethylhydrindamine.
β-Triphenylguanidine.
 Tripropylenediamine.
 Xylidines.
m-Xylamine.
m-Xyl-*p*-toluidine, amino-.

Amino-acids in plants (EMMERLING), A., ii, 612.

Amino-acids, formation of benzoyl derivatives of, by the fission of proteids (SCHULTZE), A., i, 595.
 aromatic, glucinyl derivatives of the esters of (EINHORN and OPPENHEIMER), A., i, 493.
α-Amino-acids, conversion of, into phenylhydantoins (MOUNEYRAT), A., i, 644.
Amino-acids. See also under Racemic.
Amino-ketones. See Ketones.
Ammonia, spectra of (HARTLEY and DOBBIE), T., 318; P., 1900, 14.
 electrolysis of (SZARVASY), T., 604; P., 1900, 3.
 liquid, some properties of (FRENZEL), A., ii, 474.
 electrical conductivity of solutions of (FRANKLIN and KRAUS), A., ii, 382.
 conductivity temperature coefficient of solutions of (FRANKLIN and KRAUS), A., ii, 645.
 molecular dissociation of, in aqueous solutions (HANTZSCH and SEBALDT), A., ii, 69.
 relation between, and salts in aqueous solution (KONOWALOFF), A., ii, 265.
 solubility of aqueous, in potassium carbonate solution (NEWTN), T., 775; P., 1900, 87.
 distribution of, between chloroform and water (DAWSON and MCCRAE), T., 1242; P., 1900, 172.
 equilibrium between manganous salts and (HERZ), A., ii, 68.
 equilibrium in the partition of an acid between cadmium hydroxide and (HERZ), A., ii, 532.
 equilibrium in the partition of an acid between zinc hydroxide and (HERZ), A., ii, 337.
 distillation of, in the estimation of nitrogen (BENEDIOT), A., ii, 573.
 action of iodine on gaseous (HUGOT), A., ii, 274.
 influence of, on magnesium salts (SCHIEBER), A., ii, 345.
 action of, on mercuric iodide and mercuridiammonium iodide (FRANÇOIS), A., ii, 208, 280, 346.
 action of dry sulphur dioxide on dry (DIVERS), P., 1900, 104; (DIVERS and OGAWA), T., 327; P., 1900, 38; (SCHUMANN), A., ii, 271.
 influence of, on the action of nitrifying organisms (WARINGTON), P., 1900, 66.
 formation of, in the liver (JACOBY), A., ii, 671.
 compound of, with ferrous iodide (JACKSON and DERBY), A., ii, 596.

- Ammonia**, gaseous, compounds of, with lithium bromide (BONNEFOI), A., ii, 478.
 compounds of, with mercuric chloride, formulae of (HOFMANN and MARBURG), A., ii, 279.
 hydroxides of, heat of formation of (DE FORCRAND), A., ii, 476.
 estimation of (VILLIERS and DUMESNIL), A., ii, 810.
 estimation of, improvement in Péligot's absorption apparatus for the (PANNERTZ), A., ii, 621.
 estimation of nitrogen and, in water, apparatus for (WESTON), A., ii, 685.
Ammoniacum resin, examination of (DIETERICH), A., ii, 118.
Ammonio-ammonium and Ammonio-nitrogen iodides (HUGO), A., ii, 274.
Ammonio-cobalt salts. See under Cobalt.
Ammonio-copper salts. See under Copper.
Ammonio-mercury salts. See under Mercury.
Ammonium salts, isomerism of, with salts of hydroxylamine, and of hydrazine (SABANÉEFF), A., ii, 18.
Ammonium magnesium arsenate (AUSTIN), A., ii, 245.
 bromiodobromide (JACKSON and DEBBY), A., ii, 596.
 chloride, temperature of maximum density of solutions of (DE COPPET), A., ii, 529.
 action of, on minerals (CLARKE and STEIGER), A., ii, 24, 219, 414.
 action of, on strontium chromate (DUMESNIL), A., ii, 625.
 perchlorate, use of, in the manufacture of new explosives (ALVISI), A., ii, 205.
 fluoride, compound of, with silver fluoride (GRÜTZNER), A., ii, 541.
 fluorohyperborate (MELIKOFF and LORDKIPANIDZE), A., ii, 139.
 telluriodate (WEINLAND and PRAUSE), A., ii, 399.
 mercuriodide, dissociation of (FRANÇOIS), A., ii, 142.
 permanganate (CHRISTENSEN), A., ii, 596.
 permanganomolybdates and salts with potassium (FRIEDHEIM and SAMELSON), A., ii, 547.
 vanadiomolybdates and silicovanadiomolybdates (FRIEDHEIM and CASTENDYCKE), A., ii, 483.
 nitrate, change of the transition point of, through the addition of potassium nitrate (MÜLLER), A., ii, 188.
Ammonium phosphates (v. KNOERRE), A., ii, 652.
 of beryllium, cadmium, and zinc, estimation of the metals in (AUSTIN), A., ii, 49.
 earthy phosphates, attempts to prepare (BARTHE), A., ii, 480.
 magnesium phosphate, composition of, (NEUBAUER; GOOCH and AUSTIN), A., ii, 108.
 sulphate as a manure (KLÖPPER), A., ii, 616.
 chromous sulphate (LAURENT), A., ii, 547.
 hydroximidosulphate, production of (DIVERS and HAGA), T., 689; P., 1900, 71.
 thiosulphate, preparation of, and action of heat on (DIVERS and OGAWA), T., 335; P., 1900, 89.
 double salt with silver and with copper haloids, thiosulphates, and sulphites (ROSENHEIM and STEINHÄUSER), A., ii, 652, 653.
 sulphite, double, with silver and copper (ROSENHEIM and STEINHÄUSER), A., ii, 652.
 amidosulphite, formation and decomposition of (DIVERS and OGAWA), T., 237; P., 1900, 38.
 imidosulphite (DIVERS and OGAWA), P., 1900, 113.
 palladous trichlorosulphite (ROSENHEIM and ITZIG), A., ii, 282.
 sulphites, preparation of, and action of heat on (DIVERS and OGAWA), T., 335; P., 1900, 39.
 thioantimonite and double salt with silver (POUGET), A., ii, 84.
 dithiocarbonate as a substitute for hydrogen and ammonium sulphides (VOGTHERR), A., ii, 241.
 trithionate, preparation of, and action of heat on (DIVERS and OGAWA), T., 335; P., 1900, 39.
Ammonium organic compounds:—
Ammonium compounds, quaternary, formation of (FISCHER and WINDAUS), A., i, 224, 484.
 salts, organic stereoisomeric, characteristics of (WEDEKIND), A., i, 155.
 alcoholates (DECKER), A., i, 522.
 cyanate, solid, preparation and properties of (WALKER and WOOD), T., 21; P., 1899, 209.
 cyanates, substituted, transformation of (WALKER and WOOD), T., 33; P., 1899, 209.
 cyanide, action of, on acetone (v. GULEWITSCH), A., i, 476.
 platosemi-ethylene and -amine chlorides (JÖRGENSEN), A., i, 542.

Amygdalinamidoxime (SCHIFF), A., i, 49.
n-**Amyl alcohol**, solubility coefficients of water and (AIGNAN and DUGAS), A., ii, 68.
Amyl chloride, action of, on calcium carbide (LEFEBVRE), A., i, 323.
 nitrite, action of, on vision (FILEHNE), A., ii, 424.
 sulphide-mercuric iodide (SMILES), T., 164; P., 1899, 240.
*iso***Amyl nitrite**, action of acetone, of methyl propyl ketone, of ethyl alcohol, and of *isocamyl* alcohol on, in presence of alcoholic hydrogen chloride (KISSEL), A., i, 620.
Amylase, preparation of (YVON), A., i, 196.
 action of, on starch (POTTEVIN), A., i, 80.
*iso***Amylcitraconic acid** (LAWRENCE), P., 1900, 156.
Amylene (*γ*-methyl-*β*-butylene) nitrosate (IPATIEFF), A., i, 3.
β-**Amylene nitrosate** (IPATIEFF), A., i, 3.
Amylogen and its hydrolysis (SYNIEWSKI), A., i, 78.
*iso***Amyloxyacetone** (KISSEL), A., i, 621.
*iso***Amylsuccinic acid**, melting point of (LAWRENCE), P., 1900, 156.
Amylxanthic acid, sodium salt of, use of, in qualitative analysis (GRASSINI), A., ii, 510.
Amyrol (v. SODEN), A., i, 401.
Anæmia, pernicious, metabolism in (v. MORACZEWSKI), A., ii, 295.
 condition of the blood in (SMITH), A., ii, 416.
Anæsthetics, action of (MEYER; BAUM), A., ii, 156.
Anagyrine and its compounds and physiological action (SCHMIDT; LITTERSCHEID), A., i, 513; (KLOSTERMANN), A., i, 516.
Analcite from Nova Scotia (CLARKE and STEIGER), A., ii, 25.
 action of ammonium chloride on (CLARKE and STEIGER), A., ii, 25, 219.
Analysis, application of the fractional precipitation of neutral salts to (FINDLAY), A., ii, 716.
 solubility of precipitates in (IMMERWAHR), A., ii, 642.
 use of iodic acid in (JØRGENSEN), A., ii, 620.
 elementary organic, absorption apparatus for (BENEDICT), A., ii, 439.
 qualitative, of the ammonium sulphide group (JEAN), A., ii, 619.
 use of ammonium dithiocarbonate in (VOGTHER), A., ii, 241.
 VOL. LXXVIII. ii.

Analysis, qualitative, use of sodium amyloxanthate in (GRASSINI), A., ii, 510.
 quantitative, use of cobaltcyanides in (MILLER and MATHEWS), A., ii, 318; (MATHEWS), A., ii, 578.
 use of hydrogen peroxide in (FRIEDHEIM and BRÜHL), A., ii, 171.
 use of sodium thiosulphate in (FAKTOR), A., ii, 691.
 volumetric, Iceland spar as a standard in (MASSON), A., ii, 436; (THIELE and RICHTER), A., ii, 620.
 acidimetry and alkalimetry in (ASTRUC), A., ii, 572.
 See also Indicator.
Ançylite from Greenland (FLINK), A., ii, 410.
Andesite from the eruptive rocks from the Salzkammergut (v. JOHN), A., ii, 219.
Andesites from Maine (GREGORY), A., ii, 90.
 from Sumatra (MILCH), A., ii, 150.
Andradite from Dartmoor (Büsz), A., ii, 217.
Anethole and its isomerides (ORNDORFF and MORTON), A., i, 289.
 and its analogues, oxidation of (BOUGAULT), A., i, 495.
Angolite (BREUSING), A., ii, 551.
Anhydride, $C_8H_8O_8$ from *l*-malic acid (WALDEN), A., i, 11.
Anhydrides, mixed, of acyclic and cyclic acids (BÉHAL), A., i, 8.
 of formic acid (BÉHAL), A., i, 580.
 organic, solubility of, in water (VAN DE STADT), A., i, 200.
 chloro-, inorganic, polymerisation of (ODDO), A., i, 92; (ODDO and SERRA), A., ii, 74.
Anhydrite, hydration of (ZUNINO), A., ii, 479.
 marine, formation of (VATER), A., ii, 541.
 and gypsum deposits at Oulx, Piedmont, minerals in the (COLOMBA), A., ii, 216.
Anhydro-acetyl and **-benzoyl-acetone-aminocamphor** (DUDEN and TREFF), A., i, 671.
Anhydro-*p*-acetylaminobenzyl alcohol (GOLDSCHMIDT), A., i, 436.
Anhydro-bases, and their azo-derivatives, constitution of (MELDOLA and EYNON), T., 1170; P., 1900, 166.
Anhydrobis-5-methoxy-7-methyldiketohydrindene-4-carboxylic acid and its esters (LANDAU), A., i, 662.
Anhydrodiacetone-carbamide, **-allylthiocarbamide**, and **-phenylthiocarbamide** (TRAUBE and LORENZ), A., i, 115.

- Anhydroethylacetoacetate-aminocamphor** (DUDEN and TREFF), A., i, 673.
- Anhydro-*p*-formylaminobenzyl alcohol** and its benzoyl derivative (GOLDSCHMIDT), A., i, 285.
- β -Anhydrohomocamphoric acid** (LAPWORTH and CHAPMAN), T., 453; P., 1900, 57.
- Anhydromalic acid** (WALDEN), A., i, 10, 11.
- p*-Anhydromethylaminobenzyl alcohol** (GOLDSCHMIDT), A., i, 436.
- Anhydro- α -naphthaquinone-2-acetonedicarboxylic acid**, 2-chloro-, ethyl ester (MICHEL), A., i, 670.
- Anhydro-*cis*-pentamethylenetricarboxylic acid** (BOTTOMLEY and PERKIN), T., 304; P., 1900, 16.
- Anhydrotriacetonediguanidine** (TRAUBE and SCHWARZ), A., i, 117.
- Anhydrotrisadiketohydrindene** (LIEBERMANN and FLATOW), A., i, 667.
- Anilides**, action of formaldehyde on (GOLDSCHMIDT), A., i, 285, 436.
- action of hypobromous acid on (CHATTAWAY, ORTON, and HURTLEY), A., i, 152.
- action of hypochlorous and hypobromous acids on (CHATTAWAY and ORTON), T., 134, 789, 797; P., 1899, 232; P., 1900, 102, 112; (CHATTAWAY, ORTON, and HURTLEY), T., 800; P., 1900, 125; (ARMSTRONG), T., 1047; P., 1900, 160.
- substituted (CHATTAWAY, ORTON, and HURTLEY), A., i, 151; (CHATTAWAY and ORTON), A., i, 152, 643.
- substitution in (ARMSTRONG), T., 1047; P., 1900, 160.
- Aniliminocarbaminothioglycollic acid** (HARRIES and KLAMT), A., i, 418.
- Aniline** and its hydrochloride, electrolysis of fused mixtures of (SZARVASY), T., 208; P., 1899, 194.
- solubility coefficients of water and (AIGNAN and DUGAS), A., ii, 68.
- action of, on α -benzoylaminocinnamic anhydride (ERLENMEYER), A., i, 550.
- reactions of, with hydroxy- and unsaturated compounds (TINGLE), A., i, 544.
- oxidation of (BAMBERGER and TSCHIRNER), A., i, 435.
- meta-sulphonation of (ARMSTRONG and BERRY), P., 1900, 159.
- antimonio-chloride and -iodides (HIGBER), A., i, 285.
- hydrochloride, double salt of, with bismuth chloride (HAUSER and VANINO), A., i, 641.
- Aniline**, hydrochloride, action of, on phosphoryl chloride (ODDO), A., i, 92.
- stannobromide (RICHARDSON and ADAMS), A., i, 151.
- tellurium bromides and chlorides (LENHER), A., i, 379.
- Aniline**, 3:4-*di*-, 2:3:4- and 3:4:6-*tri*-, and 2:3:4:6-*tetra*-bromo- (WHEELER and VALENTINE), A., i, 26.
- pentabromo*-, diazo-salts of (HANTZSCH and SMYTHE), A., i, 316.
- 4-*mono*-, 4:6-*di*-, and 2:4:6-*tri*-bromo-3-iodo- (WHEELER and VALENTINE), A., i, 26.
- 3-chloro-4-*mono*-, 4:6-*di*-, and 2:4:6-*tri*-bromo-, 4-chloro-3-bromo-, 3:4:6-chlorobromonitro-, and 3-chloro-4-bromo-2:6-dinitro- (WHEELER and VALENTINE), A., i, 25, 26.
- 4:2-, and 2:4-chlorobromo- (CHATTAWAY and ORTON), A., i, 643.
- "cyano-" and its acetyl and anhydrobenzoyl derivatives (MEVES), A., i, 483.
- o-nitro-, action of formaldehyde on (MEYER and ROHMER), A., i, 222.
- methylated, nitrosoamines of (BAMBERGER and MÜLLER), A., i, 217.
- Anilineazobenzoylacetone**, *i*-*p*-nitro-. See Benzeneazobenzoylacetone, *p*-nitro-.
- Anilinoacetic acid**, action of sodium and amyl alcohol on (EINHORN and PFEIFFER), A., i, 221.
- ethyl ester, action of sodium ethoxide on (VORLÄNDER and DE MOUILPIED), A., i, 644.
- Anilino-diphenylbenzoquinone** (BORSCHKE), A., i, 594.
- Anilino-diphenylguanidine**, action of carbonyl chloride on (SCHALL), A., i, 464.
- 7-Anilino-3:4-diphenyltriazole** (BUSCH and BAUER), A., i, 415.
- Anilinoembellic acid** (HEFFTER and FEUERSTEIN), A., i, 498.
- 3-Anilino-*flavinduline* chloride**, 2-amino- (KEHRMANN and STOFFEL), A., i, 225.
- 3-Anilino-1-indone** (SCHLOSSBERG), A., i, 665.
- Anilinoinduline**, B., 4, electrolytic preparation of (SZARVASY), T., 207; P., 1899, 194.
- Anilinomalonic acid**, ethyl ester, action of nitrous acid on (CURTISS), A., i, 482.
- Anilinomauveine** (*anilinophenylphenosafranine*) (FISCHER and HEPP), A., i, 462.

- Anilino-4-methylpyrimidines**, 2- and 6-, and their amino-derivatives (GABRIEL and COLSON), A., i, 54.
- Anilinophenosafranine** (FISCHER and HEPP), A., i, 463.
- Anilinophenylglycine-*o*-carboxylic acid**, and esters (VORLÄNDER and WEISSBRENNER), A., i, 295.
- 9-Anilino-7-phenylnaphthaphenazonium 7-chloride**, 10-amino- (KEHRMANN and VALENCIEN), A., i, 255.
- Anilinophenylphenosafranine** (FISCHER and HEPP), A., i, 463.
- 5-Anilino-4-phenyltriazole** and its acetyl and 3-methyl derivatives (BUSCH and BAUER), A., i, 414.
- Animal fluids**, estimation of the reducing power of (ROSIN), A., ii, 319.
- juices and tissues, chemico-physical relations of (OKER-BLOM), A., ii, 290, 356, 607.
- matter, detection of nitric acid in (VITALI), A., ii, 46.
- Animals**, marine, death temperature of (VERNON), A., ii, 93.
- Anime**, East and West Indian, examination of (DIETERICH), A., ii, 118.
- Anisaldehyde** (*o*-methoxybenzaldehyde), preparation of (LABBÉ), A., i, 177.
- p*-Anisaldoximes** (CARVETH), A., i, 34.
- Anisidine**, chloro-*o*-, *m*- and *p*-, and their acetyl derivatives (REVERDIN and ECKHARD), A., i, 28.
- dinitro-, diazotisation of (MELDOLA and WECHSLER), T., 1172; P., 1900, 167.
- "**Anisidines**, cyano-*o*-, and *p*-," and their guanidine derivatives (MEVES), A., i, 483.
- Anisoin**, preparation of (ORNDORFF and MORTON), A., i, 289.
- Anisole**, diamino-, dihydrochloride (HERZIG and AIGNER), A., i, 545.
- o*-, *m*-, and *p*-chloro-, and their nitro-derivatives (REVERDIN and ECKHARD), A., i, 28.
- Anisole-diazoeyanides**, and -diazonium cyanide (HANTZSCH), A., i, 567.
- Anisolesyndiasotato**, potassium (HANTZSCH), A., i, 567.
- Anisole-diazoaloids** (HANTZSCH), A., i, 568.
- αβ*-Anisoylanisylcarbamide** (VAN DAM), A., i, 172.
- Anisylanthranillic acid** (PSCHORR and WOLFES), A., i, 170.
- Ankerite** from Missouri (ROGERS), A., ii, 550.
- Anatto**, colouring matter of (ZWICK), A., i, 513.
- Annual General Meeting**, T., 556; P., 1900, 77.
- Anorthoclase** from Portland, Maine (LORD), A., ii, 603.
- Anthracene**, refraction of (CHILESOTTI), A., i, 339.
- Anthracite** and anthraxolite from Canada (ELLIS and LAWSON), A., ii, 660.
- estimation of volatile combustible matter in (MEADE and ATTIX), A., ii, 168.
- Anthragallool** (1:2:3-*trihydroxyanthraquinone*), its acyl and halogen derivatives (SLAMA), A., i, 181.
- Anthraglucoosennia** (TSCHIRCH and HIEPE), A., i, 682.
- Anthranillic acid** (*o*-aminobenzoic acid), from *o*-nitrotoluene (PREUSS and BINZ), A., i, 392.
- action of acetonitrile on (BOGERT and GOTTHELF), A., i, 412.
- action of chloroform and potash on (ELLIOTT), T., 213; P., 1899, 243.
- ethyl ester, formation of indigotin from (VORLÄNDER and KOETTNITZ), A., i, 649.
- glyciny derivatives of the esters of (EINHORN and OPPENHEIMER), A., i, 493.
- Anthranilic acid**, 3:6-dichloro- (GRAEBE and GOUREVITZ), A., i, 547.
- Anthranilphenylacetic acid** (HENZE), A., i, 119.
- 9-Anthranol-2-carboxylic acid** and dinitro- (LIMPRICHT and LACH), A., i, 31.
- Anthraphenones** (PERRIER), A., i, 350.
- Anthraquinone-2-carboxylic acid** and dinitro- (LIMPRICHT and LACH), A., i, 31.
- Antifebrin**, test for, in antipyrine (RAIKOW and SCHTARBANOW), A., ii, 456.
- Antimony**, alleged transformation of phosphorus into (WINKLER), A., ii, 476; (FITTICA), A., ii, 651.
- Antimony alloys** with tin (REINDERS), A., ii, 731.
- Antimony compounds** with sulphur (FAKTOR), A., ii, 598.
- Antimony trichloride** in cryoscopy (TOLLOZKO), A., ii, 190.
- pentachloride*, compound of, with nitrosyl chloride (VAN HETEREN), A., ii, 187.
- Antimonous oxide** action of, on sulphur chloride (ODDO and SERRA), A., ii, 74.
- Tri- and tetra-antimonie acids** and their salts (DEACROIX), A., ii, 145.
- Antimony sulphide**, action of hydrogen on (PÉLABON), A., ii, 352.
- Antimony, organic compounds** (PARTHEIL and MANNHEIM), A., i, 479.

- Antimony**, double halogen salts of, with aniline and the toluidines (HIGBER), A., i, 285.
- Antimony**, estimation and separation of:—
 estimation of, electrolytically (OST and KLAPPROTH), A., ii, 692.
 estimation of, in ores (BROWN), A., ii, 51.
 estimation and separation of arsenic and, in ores (BECK and FISHER), A., ii, 312.
 separation of arsenic and tin from (MARBURG), A., ii, 248.
- Antipeptone** (KUTSCHER), A., i, 72.
- Antipyrine** (1-phenyldimethylpyrazolone), compounds of, with copper chloride, and with metallic benzoates and salicylates (SCHUYTEN), A., i, 57.
 compounds of, with mercury halogen salts (VILLER and ASTRE), A., i, 362, 411.
 action of iodine on (BOUGAULT), A., i, 311, 312.
 excretion of (LAWROFF), A., ii, 741.
 and amino-, reactions of (HOFFMANN), A., ii, 379.
 tests for antifebrin, exalgin and phenacetin in (RAIKOW and SCHARBANO), A., ii, 456.
- Antipyrine**, bromo- (MICHAELIS and SCHWABE), A., i, 695.
 iodo- (BOUGAULT), A., i, 312.
 compounds of, with mercury salts (BOUGAULT), A., i, 312, 361.
- Antipyrine benzoates**. See Benzopyrines.
- Antipyrine-1-p-benzoic acid** (antipyrine-Bz-p-carboxylic acid), (MICHAELIS and SUDENDORF), A., i, 696.
- Antipyrine salicylates**. See Salipyrrines.
- Apigenin** (1-3-4'-trihydroxyflavone), synthesis of, and its triacetyl derivative (CZAJKOWSKI, v. KOSTANECKI, and TAMBOR), A., i, 504.
- Apigenin** and **Apilin**, action of nitric acid on (PERKIN), T., 416; P., 1900, 44.
- Apigetrin**, and nitro- (PERKIN), T., 420; P., 1900, 45.
- isoApiole**, acid, $C_{15}H_{14}O_6$, from the oxidation of (BOUGAULT), A., i, 495.
- Apios tuberosa**, composition of (BRIGHETTI), A., ii, 498.
- Aplysia**, digestion of carbohydrates by (RÜHMANN), A., ii, 289.
- Apple chips**, estimation of zinc in (LEHMANN), A., ii, 170.
 trees. See Agricultural Chemistry.
- Arabic acid** from beetroot (VOTOČEK and SEBOR), A., i, 208.
- Arabinose** from tragacanth (WIDTSON and TOLLENS), A., i, 207.
- Arabinose**, fermentation of (SALKOWSKI), A., i, 628.
- α -Arabinose**, phenylbenzylhydrazone of (RUFF and OLLENDORFF), A., i, 77.
- l-Arabinose**, amylicercapal and diphenylhydrazones of (NEUBERG), A., i, 539.
 phenylosazones of (NEUBERG), A., i, 189.
 conversion of, into l-erythrose (WOHL), A., i, 140.
- r-Arabinose** in urine, and phenylhydrazones, osazones, and amylicercapal of (NEUBERG), A., i, 539.
- Aragonite** and calcite, physicochemical relations of (FOOTE), A., ii, 541.
- Aralia nudicaulis**, araliene and oil from (ALPERS), A., i, 107.
- Araroba powder** (HMSER), A., i, 41.
- Arctostaphylos Uva-ursi**, constituents of (PERKIN), T., 424; P., 1900, 45.
- Arenicols**, the pigment of the (FAUVEL), A., ii, 227.
- Arginine** from coniferous plants (SUZUKI), A., ii, 562.
 from the proteid of conifer seeds (SCHULZE and WINTERSTEIN), A., ii, 101.
 from malt, formation of (PETIT and LABOURASSE), A., ii, 612.
 constitution of (SCHULZE and WINTERSTEIN), A., i, 110.
 identity of animal and vegetable (SCHULZE), A., i, 515.
 action of, on the tryptic digestion of proteid (LAWROFF), A., ii, 28.
- Argon**, new lines in the spectrum of (NASINI, ANDERLINI, and SALVADORI), A., ii, 181.
 relative rates of effusion of, and of other gases (DONNAN), A., ii, 390.
 solubility of, in water (ESTREICHER), A., ii, 205.
 passage of, through thin films of indiarubber (RAYLEIGH), A., ii, 342.
 viscosity of, as affected by temperature (RAYLEIGH), A., ii, 590.
- Aromatic compounds**, colour reaction for certain (BURGESS), A., ii, 774.
 series, isomerism in the (OCHSNER DE CONINCK), A., i, 592.
- Arsenic**, supposed transformation of phosphorus into (WINKLER), A., ii, 476; (FITTICA), A., ii, 651; (NÖLTING and FEUERSTEIN), A., ii, 722.
 action of potassammonium on (HUGOT), A., ii, 14.
 in the organism, origin, localisation, and elimination of (GAUTIER), A., ii, 162, 226.

- Arsenic**, elimination of, from the system (SCHERBATSCHOFF), A., ii, 622.
 metabolism of (GAUTIER), A., ii, 670.
Arsenious oxide, action of, on sulphur chloride (ODDO and SERRA), A., ii, 74.
Arsenic acid, estimation of, iodometrically (GOOCH and MORRIS), A., ii, 686.
Arseno-duodeci- and -luteo-tungstic acids (KEHRMANN and RÜTTIMANN), A., ii, 145.
Arsenic sulphide, action of hydrogen on (PÉLABON), A., ii, 652.
 new sulphide of (As_2S) (SCOTT), T., 651; P., 1900, 69.
Arsenic, detection, estimation, and separation of:—
 Bettendorf's test for (DIETZE; ENELL; FRERICHs), A., ii, 244.
 biological proof of the presence of (ABEL and BUTTENBERG), A., ii, 299.
 biological detection of, in skin, hairs, perspiration, and urine (SCHOLTZ), A., ii, 244.
 detection of, in the organism (SCHERBATSCHOFF), A., ii, 622.
 detection and estimation of, in the organism (GAUTIER), A., ii, 168.
 estimation of, in alloys and metals (HOLLAND and BERTIAUX), A., ii, 438.
 estimation of, in Paris green (SMITH), A., ii, 47; (HAYWOOD; HILGARD), A., ii, 758.
 estimation and separation of antimony and, in ores (BECK and FISHER), A., ii, 312.
 separation of antimony and tin from (MARBURG), A., ii, 248.
Arsenical insecticides, adulteration and analysis of (HAYWOOD; HILGARD), A., ii, 758.
Asbestos, composition of (VAN DER BELLEN), A., ii, 602.
 retention of moisture by (AUCHY), A., ii, 309.
Asbestos filters (LOHSE and THOMAS-CHIEWSKI), A., ii, 508.
Asetic fluid, human, lipolytic ferment in (HAMBURGER), A., ii, 420.
Ash analysis, apparatus for (TUCKER), A., ii, 52; (SHUTTLEWORTH and TOLLENS), A., ii, 111.
 See also Agricultural Chemistry.
Asparagine, accumulation of, in leguminous plants (BRÉAL), A., ii, 301.
Aspergillus niger, proteolytic enzyme produced by (MALFITANO), A., ii, 493.
 nutritive value of raffinose for (GILLOT), A., ii, 99.
Aspergillus Oryzæ, composition of the spores of (ASO), A., ii, 563.
 a ferment of "sake" (KOZAI), A., ii, 743.
Asphalt from Barbados (BEDSON), A., ii, 20.
Aspidin and Aspidinol (HAUSMANN), A., i, 49.
Association. See Affinity.
Astragalose from *Astragalus caryocarpus* (FRANKFORTER), A., ii, 747.
Asymmetry and vitalism (ULPIANI and CONDELLI), A., ii, 463.
Atmospheric air, composition of, at various altitudes (HINRICHS), A., ii, 649.
 combustible gases of (GAUTIER), A., ii, 537, 538, 720.
 heat of vaporisation of (BEHN), A., ii, 260.
 liquid, distillation of, and the composition of the gaseous and liquid phases (BALY), A., ii, 589.
 change in composition of, on evaporation (GROUSINOFF), A., ii, 720.
 influence of the temperature of, on Bacteria (MACFADYEN and ROWLAND), A., ii, 610.
 of forests, high mountains, and the sea (GAUTIER), A., ii, 537, 538.
 of the Tharandt forest, sulphur dioxide in the (WISLICIENUS), A., ii, 38.
 of Paris, combustible gases of the (GAUTIER), A., ii, 537, 720.
 estimation of carbon dioxide in (WALKER), T., 1110; P., 1900, 164; (LETTs and BLAKE), A., ii, 622.
 estimation of formaldehyde in (WINTGEN), A., ii, 117.
Atomic heats, additivity of (MEYER), A., ii, 464.
Atomic theory, Dalton's, genesis of (DEBUS), A., ii, 136.
Atomic weight of a new metal from uranium residues (CURIE), A., ii, 83.
 of barium, boron, bromine, carbon, chlorine, hydrogen, oxygen, silver, sodium, and sulphur (HINRICHS), A., ii, 534.
 of radio-active barium (CURIE), A., ii, 83, 654.
 of boron (GAUTIER), A., ii, 14, 15; (HINRICHS), A., ii, 534, 539.
 of cobalt (RICHARDS and BAXTER), A., ii, 78.
 of gadolinium (BENEDICKS), A., ii, 209; (DEMARÇAY), A., ii, 597.
 of iron (RICHARDS and BAXTER), A., ii, 407.

- Atomic weight of nitrogen** (DEAN), T., 117; P., 1899, 213.
of palladium (HARDIN), A., ii, 85.
of tungsten (SMITH and HARDIN), A., ii, 80.
of yttrium (MUTHMANN and BÜHM), A., ii, 209.
- Atomic weights**, report of the American Committee on (CLARKE), A., ii, 339.
report of the International Commission on (LANDOLT, OSTWALD, and SEUBERT), A., ii, 533.
and crystallography (MUTHMANN), A., ii, 533; (LINCK), A., ii, 717.
in relation to physical properties (SANDER), A., ii, 137; (BAYLEY), A., ii, 188.
and specific heat (TILDEN), A., ii, 524.
- Atoms**, additive nature of the properties of (MEYER), A., ii, 533.
- Atriplex semibaccata*. See Agricultural Chemistry.
- Atropa Belladonna*, estimation of the alkaloids of the leaves of (SCHMIDT), A., ii, 379.
- Atropine**, action of chloroform or ether on (SCHAEER), A., ii, 455.
- i*-**Atropine** from *Scopolia atropoides* roots (HESSE), A., i, 50; (GADAMER), A., i, 356.
- Atroscine**, (*atrosine*, *i*-*scopolamine*, *i*-*hyosine*), from commercial scopolamine (HESSE), A., i, 50; (GADAMER), A., i, 356.
- Augite** from Japan (IWASAKI), A., ii, 286.
from Latium (ZAMBONINI), A., ii, 662.
from Moravia (PELIKAN), A., ii, 662.
- Auramine**, constitution of (STOCK), A., i, 258.
- Austrium** (PRIBRAM), A., ii, 347.
- Autodigestion** of the pancreas (PFÖRRINGER), A., ii, 28.
- Auxidation**. See Oxidation.
- Axinite** from Japan (JIMBŌ), A., ii, 87.
- Azelaic acid** (*heptanedicarboxylic acid*), preparation of (MAQUENNE), A., i, 135.
- Asimino benzene**, ketochlorides and quinones of, and acids therefrom (ZINCKE, STOFFEL, and PETERMANN), A., i, 524.
- Asimino ethylenedicarboxylic acid**. See 1:2:3-Triazole-4:5-dicarboxylic acid.
- Asimino ethylenedicarboxylic acid**. See 1-Hydroxy-1:2:3-triazole-4:5-dicarboxylic acid.
- Asines**, formation of, by the decomposition of semicarbazones (KIPPING), P., 1900, 64; (YOUNG and WITHAM), P., 1900, 78.
- Asocamines and Asocamine oxides**, difference in behaviour of (BAMBERGER and STIEGELMANN), A., i, 193.
- Azobenzene**, electrolysis of (LÖB), A., i, 697; ii, 706.
nitro-derivatives of (WEKNER and STIASNY), A., i, 194; (MEIGEN and NORMANN), A., i, 702.
- Azobenzene-4:3:5'-trisulphonic acid** and its 4'-amino-derivative and their salts (JUNGHAHN), A., i, 418.
- Azo-compounds** differentiated from hydrazone compounds by bromine (ARMSTRONG), P., 1899, 243.
o-amino-, triazines from (BUSCH and HARTMANN), A., i, 59.
- Azo-compounds**. See preceding entries, and also:—
Acetophenoneazobilirubin.
Acetylamino benzene-*o*-1-phenyl-3-methylpyrazolone.
Acetylamino phenylazoacetoacetic acid. Aldazines.
Aniline, diazo salts of.
Anisole diazocyanides.
Anisole diazohaloids.
Anisole diazonium cyanide.
Anisolesyndiotates.
Azodibenzoyl.
Azodicarbamide.
2-Azolepidine.
Azo-mono- and -di-quinoline.
Azotoluene.
Azoxyanisole.
Azoxybenzene.
Azoxydiquinoline.
Benzaldazine.
Benzeneazobenzoylacetone.
Benzeneazo-*o*-dibromophenol.
Benzeneazo-4-chloro-*m*-phenylenediamine.
Benzeneazodiacetylsuccinic acid.
Benzeneazodiphenylamine oxide.
Benzeneazo-ethyl- β -naphthylamine.
3-Benzeneazo-6-hydroxybenzylideneacetophenone.
Benzeneazomethyl aniline oxide.
Benzeneazo- β -naphthol.
Benzeneazo- β -naphthylcarbamic acid.
Benzeneazo-*o*-nitrophenol.
Benzeneazonitrosobenzene.
Benzeneazophenol.
Benzeneazosalicylaldehyde.
Benzene-6-diazoaminoquinoline.
Benzenediazocyanide.
Benzenediazonium salts.
Benzenediazonium-*o*-sulphonic acid.
Bisdiazocetic acid.
Bisdiazobenzene phenyltetrazone.
Bisdiazobenzene-*p*-tolyltetrazone.
Bisdiazomethane (*dihydrotetrazine*).
Bisdiazotetrazones (*octazines*).
Bis-*p*-diazotoluene phenyltetrazone.
Bis-1-phenyl-3-methylpyrazoloneazobenzene.

Azo compounds. See:—

Caffeineazo-compounds.
 Capronaldazine.
 ψ -Cumenediazocyanides.
 ψ -Cumenediazohaloids.
 ψ -Cumenediazonium cyanide.
 ψ -Cumenesyndiazotates.
 Diazoacetic acid.
 Diazoaminobenzene.
 Diazoaminobenzenedi-*p*-sulphonic acid.
 Diazoazobenzenetrisulphonic acid.
 Diazobenzene.
 Diazobenzenebenzylamine.
 Diazobenzene chloride and nitrate.
 Diazobenzenehydrazides.
 Diazobenzene-*m*-hydrazinobenzoic acid.
 Diazobenzeneimide.
 Diazobenzenephenylhydrazide.
 Diazobenzenepiperidide.
 Diazobenzene-*o*-sulphonic acid.
 Diazobenzoic acid phenylhydrazide.
 Diazocaffeine.
 Diazo-compounds.
 Diazo-cyanides.
 Diazo-cymene nitrate.
 Diazohaloids.
 Diazohydrazides.
 Diazohydroxides.
 Diazohydroxyaminobenzene.
 Diazomethane.
 Diazonaphthalene nitrate.
anti-Diazonaphthalene salts.
 Diazonium salts.
 Diazosalicylic acid.
 Diazotates.
 Diazotetronic anhydride.
 Diazotetronosulphonic acid.
 Diazothiocyanates.
p-Diazotoluenephenylhydrazide.
 Diazotoluenepiperidide.
 Dibenzoxo-*o*-benzylideneazine.
 Diethylaminophenyl- μ -cyanoazomethine derivatives.
 Dihydrodiazotetronic anhydride.
 Dihydropyrazine.
 Dihydroxydiazobenzene.
 Dimethylaminobenzene-6-azoquinoline.
 Dimethylaminochlorophenazine.
 Dimethylaminophenyl- μ -cyanoazomethine derivatives.
 2:4-Dimethylbenzalazine.
 Dimethyltolueneazammonium silver iodide.
 Diphenylazoethylenetrimethylenediamine.
 Diphenyltetrazonium chloride.
 2-Hydrazolepidine.
 2-Hydrazoquinoline.
 Hydroxyazobenzene.

Azo-compounds. See:—

Hydroxyazo-compounds.
 Hydroxyazoxybenzenes.
 Hydroxydinitrobenzeneazodiphenylaminesulphonic acid.
 Menthazine.
 Mesitylenediazoidide.
p-Methylbenzalazine.
 Naphtha- β -ketopentamethylene-azine.
 Naphthaphenazine.
 1:2-Naphthazine-6:6'-disulphonic acid.
 Octazonones.
 Oxyazo-compounds.
 Phenolazobenzenesazophenol.
 Phenyl diazopyridothiazinone.
 2-Phenyl-3-(or 5)-methyl-4-*p*-nitrobenzeneazo-5-(or 3)-phenylpyrazole.
 1-Phenyl-3-methylpyrazoloneazobenzeneazoacetoacetic acid.
 3-(or 5)-Phenyl-4-*p*-nitrobenzeneazo-5-(or 3)-methyliso-oxazolone.
 3-(or 5)-Phenyl-4-*p*-nitrobenzeneazo-5-(or 3)-methylpyrazolone.
 Propionaldazine.
 Resorcinol-*o*-azosalicylic acid.
p-Sulphobenzeneazodiphenylamine-sulphonic acid.
p-Tolueneazo-4-chloro-*m*-phenylenediamine.
o-Tolueneazotolylcarbamic acid.
 Trisbisdiazomethanetetra-carboxylic acid.
as-m-Xyleneazo-4-chloro-*m*-phenylenediamine.
Azodibenzoyl (STOLLÉ and BENBATH), A., i, 531.
Azodicarbamide, condensation of, with aromatic aldehydes (YOUNG and WITHAM), T., 224; P., 1900, 5.
Azo-dyes, dynamical researches on (GOLDSCHMIDT and KEPPELER), A., i, 367.
Azoimide, electrolysis of (SZARVASY), T., 606; P., 1900, 3; (PERATONER and ODDO), A., ii, 651.
 dissociation constant of (WEST), T., 705; P., 1900, 74.
 reduction of (CURTIUS and DARAPSKY), A., ii, 475.
 metallic derivatives of (CURTIUS and DARAPSKY), A., ii, 474.
2-Azolepidine (MARCKWALD and CHAIN), A., i, 521.
Azonium bases, structure of (GREEN), A., i, 119.
 wandering of the *o*-quinonoid double linking in (KEHRMANN), A., i, 254.
 as pseudo-bases (HANTZSCH and KALE), A., i, 114.

- Asophenine**, electrolytic preparation of (SZARVASY), T., 207; P., 1890, 194.
- 2-Asoquinoline** and its salts (MARCKWALD and MEYER), A., i, 521.
- 6-Aro-mono- and -di-quinoline** (KNUEPPEL), A., i, 188.
- Asotoluene**, *o*-amino-, action of phenyl- and *p*-tolyl-thiocarbimides on (BUSCH and HARTMANN), A., i, 59.
- 4:4'-Asotoluene**, 2:2'-dinitro- (MEIGEN and NORMANN), A., i, 702.
- p*-Asoxyanisole**, crystalline modifications of (SCHENCK), A., ii, 339.
- cryoscopic constant of (AUWERS), A., ii, 263.
- Asoxybenzene** 10, nitro-derivatives of (WERNER and STIASNY), A., i, 194.
- Asoxydiquinoline** (KNUEPPEL), A., i, 188.
- Anthiotetride derivatives** (HELLSING), A., i, 518.
- B.**
- Bacillus anthracis***, bacteriolysis of the (MALFITANO), A., ii, 677.
- action of, on carbohydrates (NAPIAS), A., ii, 493.
- coli* and *B. d'Eberth*, action of, on nitrates (GRIMBERT), A., ii, 97.
- coli communis*, gas producing power of, under different conditions (PENNINGTON and KÜSEL), A., ii, 678.
- fermentationis cellulose*, morphology of (OMELIANSKY), A., ii, 493.
- lactic acid, effect of various substances on the (BOKORNY), A., ii, 297.
- formation of acetic acid by (BARTHEL), A., ii, 742.
- aerogenic, of milk, identity of, with the pneumo-bacillus of Friedländer (GRIMBERT and LEGROS), A., ii, 493.
- pyocyaneus*, colouring matters of (BOLAND), A., i, 70.
- typhoid, action of toxic products of, on the heart (KEMP and DEWEY), A., ii, 559.
- viscosus brucei*, behaviour of (VAN LAER), A., ii, 158.
- Bacteria**, influence of the temperature of liquid air and of liquid hydrogen on (MACFADYEN and ROWLAND), A., ii, 610.
- influence of metals on broth cultures of (ISACHENKO), A., ii, 230.
- action of solutions of salts of fatty acids on (LÖVINSON), A., ii, 745.
- replacement of potassium salts by rubidium salts in the development of (LOEW), A., ii, 36.
- Bacteria**, influence of, on the decomposition of bones (STOKLASA, DUCHÁČEK, and PITRA), A., ii, 684.
- importance of, for plant development (STOKLASA), A., ii, 360.
- acetic (HENNEBERG), A., ii, 297.
- denitrifying and nitrifying. See Agricultural Chemistry.
- ester-producing (MAASSEN), A., ii, 231.
- Bacterium**, a sugar (WARD and GREEN), A., ii, 33.
- sorbose, oxidation of erythritol by the (BERTRAND), A., i, 377.
- Balance Sheet** of the Chemical Society, March, 1900, and of the Research Fund, March, 1900. See Annual General Meeting, T., 588.
- Balsam**, of *Abies canadensis* (TSCHIRCH and BRÜNING), A., i, 678.
- of *Abies pectinata* (TSCHIRCH and WEIGEL), A., i, 679.
- of *Larix decidua* (TSCHIRCH and WEIGEL), A., i, 680.
- Barbaloins**, and their chloro- and bromo-derivatives (LÉGER), A., i, 512.
- Barbarea praeox*, constituents of (GADAMER), A., i, 49.
- Barbituric acid**, nitroso- (*violuric acid*), heat of dissociation of (ABEGO), A., ii, 190.
- Barium amalgam** (KEPP and BÜTTGER), A., ii, 656.
- Barium salts**, toxic action of, in plant culture (COUPIN), A., ii, 363; (SUZUKI), A., ii, 561.
- Barium aluminates** (ALLEN and ROGERS), A., ii, 727.
- borates, action of carbon dioxide on (MORSE and HORN), A., ii, 626.
- bromide, electrolysis of solutions of (SARGHEL), A., ii, 401.
- chlorate, decomposition products of (SODEAU), T., 137; P., 1890, 157.
- hydroxide, action of hydrogen peroxide on (DE FORCRAND), A., ii, 277.
- peroxides, hydrated (DE FORCRAND), A., ii, 344.
- phosphide, crystallised (JABOIN), A., ii, 76.
- hydroximidosulphate, production of (DIVERS and HAGA), T., 690; P., 1900, 71.
- thioantimonite (POUGET), A., ii, 84.
- Barium**, detection and separation of:—
- Barium**, detection of calcium, strontium, and (DUMESNIL), A., ii, 625.
- separation of strontium, calcium and (KÜSTER), A., ii, 108.
- Barium**, radio-active (v. LENGUEL), A., ii, 402; (GIESEL), A., ii, 480; (DEBIERNE), A., ii, 586.

- Barium**, radio-active, atomic weight of (CURIE), A., ii, 83, 654.
- Barley**. See Agricultural Chemistry.
- Base**, $C_8H_{13}N$, $C_9H_{13}N$, and $C_9H_{17}N$, from methylcycloheptenoneoxime (WALLACH), A., i, 46.
- $C_8H_{15}ON$, from the action of bromine on lupanine hydrochloride (CALLSEN), A., i, 186.
- $C_9H_{15}N$, and $C_9H_{19}N$, from thujaketoneoxime (WALLACH), A., i, 45.
- $C_9H_{17}N$, from fenchocamphorone (WALLACH, NEUMANN, and V. WESTPHALEN), A., i, 241.
- $C_9H_{17}ON$, from pomegranate root (PICCININI), A., i, 110.
- $C_{10}H_9O_2N_6$, from 4-methylpyrimidine and nitric acid (GABRIEL and COLMAN), A., i, 56.
- $C_{12}H_{25}N_2$, from the reduction of leucinimide (COHN), A., i, 466.
- $C_{12}H_{13}O_2N$, by distilling decahydro-acridinedione (VORLÄNDER and KALKOW), A., i, 99.
- $C_{12}H_{15}N$, from $C_{14}H_{17}N$, from tetrahydrocarbazole (PLANCHER), A., i, 562.
- $C_{13}H_{21}ON$, from alcoholic potash and ethyl 2-methylcamphenepyrrole-3-carboxylate (DUDEN and TREFF), A., i, 673.
- $C_{30}H_{18}ON_3$, from the decomposition of $C_{32}H_{26}N_6(NO)_2$, formula of (SCHALL), A., i, 464.
- Wessel's, $C_{32}H_{26}N_6$, and its dinitroso-derivative (SCHALL), A., i, 464.
- $C_{44}H_{41}O_7N$, by the action of alcoholic ammonia on the ethyl ester of the acid $C_{24}H_{24}O_4$ (COEN), A., i, 308.
- Bases**, formation of, from albumin (COHN), A., i, 466.
- from the reduction of camphoceenonitrile (BLAISE and BLANC), A., i, 184.
- from paramucosin (LEATHES), A., i, 318.
- from Californian petroleum (MABERY), A., i, 533.
- action of potassium permanganate on (WILLSTÄTTER), A., i, 404.
- aromatic, action of carbonyl chloride on (VITTENER), A., i, 153.
- See also Pseudo-bases.
- Basicity**, difference of, of the two amino-groups of substituted diamines (BÜLOW), A., i, 690.
- Basic slag**. See Slag, basic, and also Agricultural Chemistry.
- Bassia nut**. See Agricultural Chemistry.
- Bassoria** (HILGER and DREYFUS), A., i, 379.
- Bean oil'** (KOSUTÁNY, WINDISCH, v. HÉRICES-TÓTH, v. SZÉLL, and FALTIN), A., ii, 750.
- Beans**. See Agricultural Chemistry.
- Bdellium resin**, examination of (DIETRICH), A., ii, 118.
- Becquerel rays**. See Photochemistry.
- Bea**, queen, albumin in the cell of the (STÜSS; KLETT), A., ii, 93.
- Beer**, volatile acids in (SPAETH), A., ii, 177.
- detection of furfuraldehyde in (HEIM), A., ii, 327.
- detection of neutralising agents in (SPAETH), A., ii, 177.
- detection of "saccharin" in (RÖSSING), A., ii, 119.
- Beer disease**, a (VAN LAER), A., ii, 158.
- Beeswax**. See Wax.
- Beet molasses**. See Agricultural Chemistry.
- Beetroot**, estimation of sugar in (KOVÁŘ), A., ii, 694.
- See also Agricultural Chemistry.
- Benz-**. See also Benzoyl, and under the Parent Substance.
- Benzal-**. See Benzylidene-.
- Benzaldazine**, reduction of (CURTIUS), A., i, 611.
- Benzaldazines**, nitro- (CURTIUS and LUBLIN), A., i, 700.
- Benzaldehyde**, velocity of the reaction between sodium hydroxide and (POMERANZ), A., i, 552.
- oxidation of, in air (v. BAEYER and VILLIGER), A., i, 487.
- condensation of, with dibenzyl ketone (GOLDSCHMIEDT and KNÖPFER), A., i, 86.
- condensation of, with methyl or ethyl acetonedicarboxylate (PETRENKO-KRITSCHENKO and ELTCHANINOFF), A., i, 307.
- action of, on ethyl- β -naphthylamine (MORGAN), T., 1210; P., 1900, 171.
- action of dry silver oxide and ethyl iodide on (LANDER), T., 746.
- compounds of, with substances belonging to the sugar group (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.
- Benzaldehyde diacetate**, nitro- (THIELE and WINTER), A., i, 500.
- Benzaldehyde pyrrolylhydrazones** (PICCININI and SALMONI), A., i, 562.
- Benzaldoxime**, preparation of (SCHOLL), A., i, 144.
- oxidation of, by Caro's reagent (BAMBERGER), A., i, 500.
- benzylether, and its *p*-bromo-, *p*-chloro-, and *p*-nitro-derivatives (SCHROETER and PESCHKES), A., i, 485.

- Benzaldoximes**, *anti*- and *syn*-, curves of the molecular vibrations of (HARTLEY and DOBBIE), T., 509; P., 1900, 58.
- Benzamide**, action of dry silver oxide and ethyl iodide on (LANDER), T., 736; P., 1900, 6.
- hexachloride*, preparation and properties of (MATTHEWS), T., 1275; P., 1900, 176.
- Benzamide**, 2:4:6-*tribromo*-, sodium salt of, and compound of, with sodium hydroxide (WHEELER), A., i, 492.
- Benzamidine**, condensation of, with the ethyl esters of acetylenedicarboxylic and chlorofumaric acids (RUHEMANN and STAPLETON), T., 809; P., 1900, 122.
- action of, on ethyl phenylpropionate (RUHEMANN and STAPLETON), T., 239; P., 1900, 11.
- Benzanilide** (SILBERRAD), T., 1191.
- o*-bromo- and -chloro-, nitrogen bromides and chlorides from (CHATTAWAY and ORTON), T., 800.
- 3:5-*di*bromo-, and *o*-chloro- (CHATTAWAY and ORTON), A., i, 643.
- Benzaniline**. See Benzophenone, *p*-amino-.
- Benzdiazimide** (MEYER and ROHMER), A., i, 223.
- Benzene**, formation of, from acetylene (SABATIER and SENDERENS), A., i, 470, 471, 534.
- refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.
- boiling-point of, with mixtures of acetone, carbon tetrachloride, chloroform, ether, and methyl alcohol (HAYWOOD), A., ii, 64.
- direct aldoxidation of (SCHOLL), A., i, 144.
- action of chlorine monoxide on (SCHOLL and NÖRR), A., i, 337.
- action of hydrogen peroxide on (CROSS, BEVAN, and HEIBERG), A., i, 534.
- derivatives, formation of tri-substituted from di-substituted (HOLLEMAN), A., i, 387.
- methyl derivatives, oxidation of, by means of acetic anhydride and sulphuric acid (THIBLE and WINTER), A., i, 500.
- vapour and hydrogen, action of platinum- and of palladium-black on (LUNGE and AKUNOFF), A., i, 543.
- vapour, estimation of, in illuminating gas (PFEIFFER), A., ii, 173.
- detection of, in denatured spirit (HALPHEN), A., ii, 446.
- Benzene**, estimation of, in coal gas (HABER), A., i, 629.
- Benzene**, bromo-, rate of formation of (BRUNER), A., ii, 647.
- and *m*-xylene dibromide, action of sodium on a mixture of (PELLEGRIN), A., i, 151.
- pentabromo*- (JACOBSON and LOEB), A., i, 281.
- 4-bromo-3-iodonitro- (WHEELER and VALENTINE), A., i, 26.
- 1:4-*di*bromo-2:3-*dinitro*- ("α-*di*bromodinitrobenzene") (CALHANE and WHEELER), A., i, 146.
- chloro- and bromo-, electrolytic preparation of (VOTOČEK and ZENÍŠEK), A., i, 19.
- chloro-, *tetrachloride*, preparation of (MATTHEWS), T., 1276; P., 1900, 176.
- mono*-, 1:2- and 1:4-*di*-, 1:2:4-*tri*- and 1:2:4:5-*tetra*-chloro-, action of bromine of (MOUNEYRAT and POURRET), A., i, 19.
- 1:2:4-*trichloro*-, and 2:4:5-*trichloro*-1-nitro- (COHN and FISCHER), A., i, 459.
- 4-chloro-3-bromonitro- (WHEELER and VALENTINE), A., i, 26.
- m*-chloriodo- (KLAGES and LIECKE), A., i, 387.
- o*- and *p*-chloronitro-, simultaneous formation of (HOLLEMAN and DE BRUYN), A., i, 638.
- chloro-*dinitro*-, action of, on potassium benzoate and on acetamide (KYM), A., i, 158.
- nitro-, electrolysis of (LÖB), A., i, 697; ii, 706.
- electrolytic reduction of (HABER), A., i, 281; ii, 257; (HABER and SCHMIDT), A., i, 282.
- nitration of (HOLLEMAN), A., i, 387; (HOLLEMAN and DE BRUYN), A., i, 481.
- reduction of, with sodium (SCHMIDT), A., i, 20.
- conversion of, into *o*-nitrophenol (WOHL), A., i, 157.
- o*-, *m*-, and *p*-*dinitro*-, formation of (HOLLEMAN), A., i, 387; (HOLLEMAN and DE BRUYN), A., i, 481.
- trinitro*-, compounds of, with sodium alkyl oxides and with ethyl sodioacetate or sodiomalonate (JACKSON and GAZZOLLO), A., i, 433.
- nitroso-, action of aqueous sodium hydroxide on (BAMBERGER), A., i, 531.
- Benzeneazimonomol**. See 1-Hydroxy-1:2:3-benzotriazole.

- Benzeneazobenzoylacetone**, *p*-nitro-, and its methylimide and phenylimide, and its condensation products with phenylhydrazine and reactions with semicarbazide sulphate, hydroxylamine and hydrochloric acid (BÜLOW), A., i, 65, 66.
- Benzeneazo-*o*-dibromophenol**, its acyl derivatives and ethyl ether (HEWITT and ASTON), T., 712; P., 1900, 89.
- p*-bromo-, and its acyl derivatives and ethyl ether (HEWITT and ASTON), T., 810; P., 1900, 131.
- Benzeneazo-4-chloro-*m*-phenylenediamine** (COHN and FISCHER), A., i, 458.
- Benzeneasodiacetylsuccinic acid**, diethyl ester of, isopyrazole derivatives from (BÜLOW and SCHLESINGER), A., i, 56.
- Benzeneasodiphenylamine oxide**, and *p*-bromo- (BAMBERGER and STIEGELMANN), A., i, 193.
- Benzeneasoethyl- β -naphthylamine**, *p*-nitro- (MORGAN), T., 1214.
- 3-Benzeneazo-6-hydroxybenzylideneacetophenone** (BORSCHKE), A., i, 419.
- Benzeneasomethylaniline oxide**, and *p*-bromo- (BAMBERGER and STIEGELMANN), A., i, 193.
- Benzeneazo- β -naphthol** (MÖHLAU and STROHBACH), A., i, 368.
- Benzeneazo- β -naphthylcarbamio acid**, ethyl ester (BUSCH and HARTMANN), A., i, 60.
- Benzeneazo-*o*-nitrophenol**, preparation, properties, and reactions of, and its acetyl and benzoyl derivatives (HEWITT), T., 99; P., 1899, 229.
- Benzeneazonitrosobenzene** (WERNER and STIASNY), A., i, 194.
- Benzeneasophenol**, bromination of (HEWITT and ASTON), T., 712, 810; P., 1900, 89, 131.
- nitration of (HEWITT), T., 99; P., 1899, 229.
- Benzeneasophenol**, *p*-nitro- and its acetyl and benzoyl derivatives, and *p*-amino-, and its acetyl derivatives (MELDOLA and WILLIAMS), P., 1899, 196.
- Benzeneasosalicylaldehyde** and the action of acetophenone on (BORSCHKE), A., i, 419.
- Benzeneacyanonitric acid**, dinitro- (trinitrobenzene cyanhydrin) (HANTZSCH and KISSEL), A., i, 90.
- Benzene-6-diazoaminoquinoline** (KNUFFEL), A., i, 188.
- Benzenediazocyanide** and its bromine derivatives and their dissociation to diazonium cyanides (HANTZSCH), A., i, 568.
- Benzenediazonium**. See Diazonium.
- Benzenediazonium-*o*-sulphonic acid** (diazobenzene-*o*-sulphonic acid), *p*-bromo-, and *syn*-diazotates from (GERILOWSKI), A., i, 706.
- Benzene-mono- and tri-dimetaphosphoric acids** (GIRAN), A., i, 146.
- Benzene-*o*-disulphonic acid** and its salts derivatives (ARMSTRONG and NAPPER), P., 1900, 160.
- Benzene potassium cyanide**, trinitro- (HANTZSCH and KISSEL), A., i, 90.
- Benzene ring**, gradual synthesis of the (DELAORE), A., i, 603.
- law governing the elimination of halogens from the (KLAGES and LIECKE), A., i, 387.
- Benzenestearosulphonic acid**. See Sulphophenylstearic acid.
- r*- α -**Benzenesulphaminobutyric acid** (FISCHER and MOUNEYRAT), A., i, 647.
- Benzenesulphocamphenamide** (DUDEN and MACINTYRE), A., i, 302.
- Benzenesulphonamides** of primary bases (DUDEN), A., i, 282; (WILLSTÄTTER and LESSING), A., i, 304.
- Benzenesulphone- and Benzenesulphone-methyl-*o*-anisidine** (DIEFOLDER), A., i, 191.
- Benzenesulphonic acid**, aromatic esters of, and compounds of, with aminophenols and acids (GEORGESCU), A., i, 343.
- 1:2:3:4-Benzenetetra-carboxylic acid** (*prehnitic acid*) (DOEBNER), A., i, 500.
- Benzenoid hydrocarbons**, refractive and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.
- action of cyanogen bromide and aluminium chloride on (SCHOLL and NÖRR), A., i, 386.
- Benzoyl-*o*-aminophenol**, *m*-nitro- (RANSON), A., i, 218.
- Benzoylanilinoxime**, its nitro-derivatives, and dinitrophenyl ethers (WERNER and HERBERGER), A., i, 58.
- Benzoylmethyliminocchloride**, decomposition of (V. PECHMANN and OBERMILLER), A., i, 294.
- pp*-Benzhydroidicarboxylic acid** (LIMPRICHT), A., i, 599.
- Benzhydroxamic acid** from the oxidation of benzaldoxime (BAMBERGER), A., i, 500.
- its acetyl, benzoyl, and chloro-derivatives (VAN RAALTE), A., i, 147.
- Benzidine**, electrolytic preparation of (LÖB), A., i, 697; ii, 706.
- colour test for (WOLFF), A., ii, 119.
- "**Benzidine, cyano-**" platinichloride (MEVES), A., i, 484.
- Benzil**, action of ethyl mercaptan on (LLAGUET), A., i, 503.

- β*-Benzildioxime**, double compounds of, with certain solvents (PETRENKO-KRITSCHENKO and KASANEZKY), A., i, 350.
- Benzimino-ethers**, rearrangement of (WHEELER), A., i, 293; (WISLICENUS and GOLDSCHMIDT), A., i, 435.
- Benzoic acid**, electrical conductivity of, influence of substituents on (TINGLE), A., ii, 6.
- oxidation of, in presence of ferrous salts (FENTON and JONES), T., 76; P., 1899, 224.
- mercury derivative of (PESCI), A., i, 548.
- potassium salt, action of chlorodinitrobenzene on (KYM), A., i, 158.
- hexachloride, preparation of (MATTHEWS), T., 1276; P., 1900, 176.
- Benzoic acid**, *p*-acetylaminobenzoylmethyl, acetylaminobenzoylmethyl, and *p*-amino-*m*-dimethylbenzoylmethyl esters (KUNCKELL), A., i, 663.
- o*-benzoylaminophenyl and *o*-benzoylmethylaminophenyl esters of, and their nitro-derivatives (RANSOM), A., i, 219.
- phenyl, *p*-tolyl, and thymyl esters, formation of (BODROUX), A., i, 224.
- Benzoic acid**, *o*-amino-. See Anthranilic acid.
- m*- and *p*-amino-, glycinyl derivatives of the esters of (EINHORN and OFFENHEIMER), A., i, 493.
- p*-amino-, action of ethyl acetoacetate and substituted acetoacetates on, in presence and absence of pyridine (TROEGER), A., i, 226.
- diaminocyno-, quinoneimide of (NIETZKI and PETRI), A., i, 486.
- 2:3:4:6-tetramino-5-cyano- (NIETZKI and PETRI), A., i, 486.
- m*-chloro-, nitration of (HOLLEMAN and DE BRUYN), A., i, 638.
- o*-, *m*-, and *p*-chloro-, and their derivatives, nitration of (HOLLEMAN), A., i, 388; (MONTAGNE), A., i, 491.
- methylamides of (MONTAGNE), A., i, 491.
- iodoso- (m. p. 228°) (VANINO and UHLFELDER), A., i, 371.
- m*-nitro-, ethyl ester, chloro- and bromo-imide of (STIEGLITZ and SLOSSON), P., 1900, 2.
- o*-, *m*-, and *p*-nitro-, formation and nitration of (HOLLEMAN), A., i, 387.
- thio- and nitrothio-, and their dinitrophenyl esters (KYM), A., i, 190.
- Benzoic chloride**, action of, on *s*-3:6-dimethylidihydrotriazine (SILBERRAD), T., 1185; P., 1900, 169.
- Benzoic chloride**, additive compound of, with aluminium chloride (KRONBERG), A., i, 502.
- Benzoic chloride**, 2:5-, 3:4-, and 4:3-chloronitro-, methylamides of (MONTAGNE), A., i, 491.
- Benzoic hydrogen peroxide** (v. BAeyer and VILLIGER), A., i, 328, 437.
- Benzoic peroxides**, bromo-, iodo- and nitro- (VANINO and UHLFELDER), A., i, 371.
- o*-Benzoisulphinide**. See "Saccharin."
- Benzoin**, action of ethyl mercaptan on (LLAGUET), A., i, 503.
- action of dry silver oxide and alkyl iodides on (LANDER), T., 783; P., 1900, 6, 90.
- Benzoin-β-phenylhydrazones**, action of benzoic chloride on (FREER), A., i, 124.
- Benzonitrile**, specific heat and heat of vaporisation of (LUGININ), A., ii, 334.
- hydrolysis of (RABAUT), A., i, 170.
- Benzonitrile hexachloride**, preparation and properties of (MATTHEWS), T., 1273; P., 1900, 175.
- Benzonitroic acid**, dinitro-, barium salt (HANTZSCH and KISSEL), A., i, 90.
- Benzophenone**, allotropy of (OECHSNER DE CONINCK), A., i, 236.
- solubility of (DERRIEN), A., i, 299.
- additive compound of, with aluminium chloride (KRONBERG), A., i, 502.
- new derivative of (OECHSNER DE CONINCK and DERRIEN), A., i, 502.
- Benzophenone**, *p*-amino- (*benzaniline*) derivatives of (DINGLINGER), A., i, 503.
- Benzophenone-3:4'-dicarboxylic acid** (LIMPRICHT), A., i, 32.
- Benzophenone-4:4'-dicarboxylic acid** (LIMPRICHT), A., i, 598.
- Benzophenone diethyl, diphenyl, and ditolyl diketones** (LIMPRICHT), A., i, 32.
- Benzophenonediphenyldiketonedicarboxylic acid** (LIMPRICHT), A., i, 32.
- Benzophenonephenylacetylene** (NEF), A., i, 21.
- Benzopyrines**, metallic (SCHUYTEN), A., i, 57.
- Benzo-γ-pyrone** and its carboxylic acid (RUHEMANN and STAPLETON), T., 1180; P., 1900, 168.
- p*-Benzoxymesityl bromide and ethyl ether, dibromo- (AUWERS, TRAUN, and WELDE), A., i, 169.
- Benzoyl-**. See also under Parent Substance.
- Benzoylacetetic acid** (RUHEMANN and STAPLETON), T., 1180; P., 1900, 168.

- Benzoylacetone**, *dithio*-, action of hydroxylamine and phenylhydrazine on (VAILLANT), A., i, 239.
- Benzoylaconitic acid**, ethyl ester of (RUHEMANN and STAPLETON), T., 804; P., 1900, 121.
- Benzoyl- α -aminobutyric acids**, *d*-, *l*-, and *r*-, (FISCHER and MOUNEYRAT), A., i, 647.
- α -Benzoylaminocinnamic anhydride**, action of amines on (ERLENMEYER), A., i, 549.
- α -Benzoylaminocinnamide** (ERLENMEYER), A., i, 549.
- Benzoylaminodiphenylguanidine** (BUSCH and BAUER), A., i, 415.
- o*-Benzoylaminophenol** and its *o*-methyl-compound and their benzoates and nitro-derivatives (RANSOM), A., i, 218.
- Benzoylaminosulphonol** (POSNER and FAHRENHORST), A., i, 16.
- p*-Benzoylanilinocinnamylformic acid**, *p*-benzanilide of (DINGLINGER), A., i, 503.
- Benzoylanisoylmethane** (POND, MAXWELL, and NORMAN), A., i, 102.
- Benzoylanthranilic acid** (PSCHORR and WOLFF), A., i, 170.
- Benzoyl-*l*-aspartic acid** and its salts (SCHULTZE), A., i, 596.
- Benzoylation** in presence of pyridine (MINUNNI), A., i, 214.
- o*-Benzoylbenzenesulphonic acid**, *p*-nitro-, and its salts and chloride (HOLLIS), A., i, 292.
- Benzoylbenzhydrol** (NEF), A., i, 21.
- Benzoylbenzimidazole ether**, action of ethyl iodide on (WHEELER), A., i, 294.
- o*-Benzoylbenzoic acid**, tautomerism of (HALLER and GUYOT), A., i, 170.
- 3:6-dichloro- and tetrachloro-**, esterification of (GRAEBE), A., i, 548.
- Benzoylbenzylidenehydrazide** (MINUNNI and CARTA-SATTA), A., i, 252; (CURTIUS), A., i, 701.
- Benzoylisobutylamide** (WHEELER), A., i, 293.
- Benzoyl-carbamides** and ψ -carbamides, formation of (WHEELER and JOHNSON), A., i, 632.
- Benzoylcarbaminothioglycollic acid** (WHEELER and JOHNSON), A., i, 633.
- Benzoylcarbinol**, *p*-amino-, and its hydrochloride and phenylhydrazone (KUNCKELL), A., i, 663.
- Benzoylcarbonyl-*o*-aminophenol** and *m*-nitro- (RANSOM), A., i, 218.
- Benzoyl-*s*-dibenzyl-*i*-diphenylethylenediamine** ("*dibenzylamarine*") (JAPP and MOIR), T., 608; P., 1899, 211.
- Benzoyl-*s*-dimethyl- and -*s*-diethyl-*i*-diphenylethylenediamine** ("*dimethyl*-" and "*diethyl-amarine*") (JAPP and MOIR), T., 608; P., 1899, 211.
- Benzoylfurfurylidenehydrazide** (MINUNNI and CARTA-SATTA), A., i, 252.
- Benzoylglutamic acid** and its salts (SCHULTZE), A., i, 596.
- 3-Benzoyl-4-hydroxyisocarbostyryl** (GABRIEL and COLMAN), A., i, 689.
- Benzoyliminothiocarbonic acid**, esters, formation of (WHEELER and JOHNSON), A., i, 634.
- Benzoylleucine** and its salts (SCHULTZE), A., i, 595.
- Benzoyl-*r*-leucine**, resolution of, into its active components (FISCHER), A., i, 646.
- o*-Benzoylmethylamino-phenol** and **-phenyl ethyl carbonate** (RANSOM), A., i, 219.
- β -Benzoyl- α -methylpropionic acid** (*phenylmethylbutanoic acid*), synthesis of (KLOBB), A., i, 497.
- 4-Benzoylnicotinic acid** (FULDA), A., i, 53.
- Benzoylphenetidinesulphonic acid** (COHN), A., i, 29.
- Benzoylphenylacetylene** and its diiodide (NEF), A., i, 21.
- action of potash on** (MOUREU and DELANGE), A., i, 397.
- Benzoyl-*d*-phenylalanine** (FISCHER and MOUNEYRAT), A., i, 647.
- p*-Benzoylphenyl-carbimide**, and **-methylurethane** (DINGLINGER), A., i, 503.
- $\alpha\alpha$ -Benzoylphenylhydrazide**, action of heat on (SILBERRAD), T., 1190; P., 1900, 169.
- α -Benzoylphenylhydrazide-*trichloroquinone*** (MCIPHERSON and FISCHER), A., i, 411.
- s*-Benzoylphenylhydrazine-*p*-sulphonic acid** (FICHTER and SCHIESS), A., i, 366.
- p*-Benzoylphenylexamic acid**, ethyl ester (DINGLINGER), A., i, 503.
- p*-Benzoylphenylsuccinimide** (DINGLINGER), A., i, 503.
- p*-Benzoylphenylthio-carbamide** and **-carbimide** (DINGLINGER), A., i, 503.
- p*-Benzoylphenylurethane** (DINGLINGER), A., i, 503.
- β -Benzoylpropionic acid** (DEBOGLAFF), A., i, 490.
- Benzoyl-2:4:6:4'-tetramethoxyacetophenone** (CZAJKOWSKI, v. KOSTANECKI, and TAMBOR), A., i, 504.
- Benzoylthiamide**, *p*-bromo- (SAULMANN), A., i, 687.

- Benzoylthiocarbimide**, reactions of, with imino-ethers (WHEELER and SANDERS), A., i, 563.
- Benzoyl-*r*-tyrosine**, resolution of, into its optically active components (FISCHER), A., i, 172.
- Benzoylusnic acid** and its oxime (PATERNO), A., i, 662.
- Benzyl alcohol**, action of methylene sulphate on (DELÉPINE), A., i, 163. *m*-nitro-*p*-amino- and its anhydro-derivative (MEYER and ROHMER), A., i, 222.
- Benzyl chloride**, *p*-cyano-, reactions of (MOSES), A., i, 658. cyanide. See Phenylacetoneitrile. hydrogen sulphate (DELÉPINE), A., i, 164. iodide, *p*-chloro- (VAN RAALTE), A., i, 147. nitrate (NEF), A., i, 5. thiocyanate, *p*-cyano-, reactions of (MOSES), A., i, 658.
- β -Benzylallylamine** and its salts (POSNER and FAHRENHORST), A., i, 18.
- Benzylaminocarboxylic acid**. See Phenylacetic acid, amino-.
- Benzylaminochloroindone** (LANSER and WIEDERMANN), A., i, 667.
- 3-Benzylamine-1-indone** (SCHLOSSBERG), A., i, 665.
- Benzylisoamylamine** (EINHORN and PFEIFFER), A., i, 222.
- Benzylaniline**, *o*-chloro-, and its nitroso-derivative (BAMBERGER and MÜLLER), A., i, 706.
- Benzylanilinesulphonic acids** (SMEDLEY), P., 1900, 160.
- Benzylascimide** (WOHL and OESTERLIN), A., i, 698; (CURTIUS), A., i, 699.
- Benzylbenzylaminooxime** and its 2:4-dinitrophenyl ether (WERNER and HERBERGER), A., i, 59.
- Benzylbenzylidenhydrazine** and its acetyl derivative (WOHL and OESTERLIN), A., i, 698. and its salts (CURTIUS), A., i, 611.
- Benzylbutylamines** (EINHORN and PFEIFFER), A., i, 222.
- Benzylcamphor**, bromo- (HALLER and MINGUIN), A., i, 452.
- Benzylcarbinol** (β -phenylethyl alcohol) from German oil of roses (v. SODEN and ROJAHN), A., i, 489. in rose blossoms (WALBAUM), A., i, 509, 645.
- Benzylchloroformoxime** (BIDDLE), A., i, 137.
- Benzylidguanide** (BRUTEL), A., i, 367.
- Benzylidimethylcarbinol** (GRIGNARD), A., i, 382.
- Benzylethylthetine** platinichloride (STRÖMHOLM), A., i, 326.
- Benzylformhydroxamic acid** (BIDDLE), A., i, 137.
- Benzylhydrazine** and its hydrochloride and nitroso-derivative (WOHL and OESTERLIN; CURTIUS), A., i, 698. synthesis of, and its dibenzoyl derivative (CURTIUS), A., i, 610. reduction of benzylidenhydrazine to (CURTIUS), A., i, 700.
- Benzyl-*o*-hydroxybenzylidenhydrazine** (CURTIUS), A., i, 611.
- α -Benzylhydroxylamine** and action of ethyl formate on (SCHROETER and PESCHKES), A., i, 485.
- Benzylidenacetoxime**, oxidation of (HARRIES), A., i, 504.
- Benzylideneaminodiphenylguanidine** (BUSCH and BAUER), A., i, 414.
- Benzylideneaminodi-*o*- and -*p*-tolyl-guanidines** (BUSCH and BAUER), A., i, 415.
- Benzylideneaniline**, *o*-chloro- (BAMBERGER and MÜLLER), A., i, 706.
- Benzylidenearsine**, formation of (YOUNG and WITHAM), P., 1900, 73. *m*- and *p*-nitro- (MINUNNI and CARTASATTA), A., i, 251.
- Benzylidenebisacetonedicarboxylic acid**, methyl ester (PETRENKO-KRITSCHENKO and ELTCHANINOFF), A., i, 307.
- Benzylidenebisacetylacetones**, six isomeric, preparation and configuration of (SCHIFF), A., i, 39.
- Benzylidenebisdihydroresorcinol**, and Benzylidenebisdimethyl- and -phenyldihydroresorcinol (VORLÄNDER and STRAUSS), A., i, 100.
- Benzylidenebis-gallacetophenone** and -resacetophenone and its ethyl ether, and their acetyl derivatives (BLUMSTEIN and V. KOSTANECKI), A., i, 448.
- Benzylidenebis-2-methylindole** (v. WALTHER and CLEMEN), A., i, 408.
- Benzylidenecampholic acid** (HALLER and MINGUIN), A., i, 452.
- Benzylidenecamphor**, action of hydrogen bromide on (HALLER and MINGUIN), A., i, 452.
- r*-Benzylidenecamphor**, resolution of; isomorphism of the active components (MINGUIN), A., i, 301.
- Benzylidenedihydroisocamphor** (RIMINI), A., i, 554.
- Benzylidenefluorene** (phenyldiphenylene-ethylene) (THIELE), A., i, 347.
- Benzylidenehydantoin** and **Benzyliden-imino- and -thio-hydantoin** (RUHMANN and STAPLETON), T., 241; P., 1900, 12.

- Benzylidenedihydrazine**, reduction of, to benzylhydrazine (CURTIUS), A., i, 700.
- o-, m-, and p-nitro-, and their reactions (CURTIUS and LUBLIN), A., i, 700.
- Benzylidene-2-lepidyl- and -4-quin-aldyl-hydrazine** (MARCKWALD and CHAIN), A., i, 521.
- Benzylidene-2-naphthylamine**, 1-bromo- and 1-chloro-, and their hydrocyanides and o- and p-nitro-derivatives (MORGAN), T., 1216; P., 1900, 171.
- Benzylidenescobornylamine** (FORSTER and HART-SMITH), T., 1157; P., 1900, 166.
- "**Benzylidenephenyldihydroresorcinol**." See Triphenyloctohydroxanthenedione.
- Benzylidenephenylhydrazone** (MORGAN), T., 1210.
- Benzylidene-mono- and -di-quinaldine and -lepidine** (KOENIGS), A., i, 189.
- Benzylidene-2-quinolyldihydrazine** and its salts (MARCKWALD and MEYER), A., i, 519.
- Benzylidenesemicarbazone**, oxidation of (YOUNG and WITHAM), T., 226; P., 1900, 5.
- 1-Benzylidene** (MARCKWALD), A., i, 434.
- Benzylisuretine** (BIDDLE), A., i, 137.
- Benzylmethylollepidine** (KOENIGS), A., i, 189.
- Benzyl-mono- and -di-methylolquinaldine** (KOENIGS), A., i, 189.
- Benzylmethylsulphine iodide** and **Benzylmethylisopropylsulphine platinichloride** (STRÖMHOLM), A., i, 326.
- Benzyl-α-naphthaquinone**, 2-chloro-3-α-cyano- (MICHEL), A., i, 669.
- Benzylloximinoformyl ethyl, acetyl, and benzoyl oxides**, and **Benzylloximino-diacetyl oxide** (BIDDLE), A., i, 138.
- Benzylloxycarbamide**, p-bromo- and p-chloro- (SCHROETER and PESCHKES), A., i, 485.
- Benzylphenylnitrosamine**, p-nitro- (BAMBERGER and MÜLLER), A., i, 706.
- Benzylquinaldine**, compound of, with chloral (KOENIGS), A., i, 189.
- Benzylisoquinolines**, 4-, 3-, and 1- (RÜGHEIMER), A., i, 522.
- Benzylsemicarbazide** (CURTIUS), A., i, 611.
- Benzylsulphide-p-dicarboxylic acid** and its nitrile (MOSES), A., i, 658.
- β-Benzylsulphoneallylphthalamide** (POSNER and FAHRENHORST), A., i, 18.
- Benzylthiocarbimide**, action of, on *Saccharomyces mycoderma* (TER MEULEN), A., i, 511.
- Berberine phosphate**, composition of (SHEDDEN), A., i, 683.
- estimation of (TROEGER and LINDE), A., i, 515.
- Bergamot oil** (CHARABOT), A., ii, 101; (SOLDANI and BERTÉ), A., ii, 173.
- Beryllium ammonium phosphate**, estimation of beryllium in (AUSTIN), A., ii, 49.
- separation of, from iron (HAVENS and WAY), A., ii, 50.
- Bendantite** (HARTLEY), A., ii, 601; (PRIOR), A., ii, 602.
- Bile**, human (v. ZEYNEK), A., ii, 29.
- as a digestive juice (BRUNO), A., ii, 553.
- as a solvent (MOORE), A., ii, 291.
- Bile pigments**, detection of, in urine (HAMMARSTEN), A., ii, 637.
- Bilirubin**, detection of, in urine (ARNOLD), A., ii, 114.
- Binnite**, identity of, with tennantite (PRIOR and SPENCER), A., ii, 21.
- Biological chemistry**, ethical and scientific questions of (THUDICHUM), A., ii, 609.
- Biotite** (?) from Japan (JIMBÓ), A., ii, 87.
- Birds**, digestion in (PAIRA-MALL), A., ii, 553.
- Bis-β-diamyldisulphonepropylthiocarbamide** (POSNER and FAHRENHORST), A., i, 17.
- Bisdiazooacetic acid** (HANTZSCH and SILBERRAD), A., i, 261.
- Bisdiazobenzenephenyltetrazone** and its halogen derivatives (WOHL and SCHIFF), A., i, 707.
- Bisdiazobenzene-p-tolyltetrazone** (WOHL and SCHIFF), A., i, 708.
- Bisdiazotetrazones (ozonones)**, formation of (WOHL and SCHIFF), A., i, 706.
- Bis-p-diazotoluenephenyltetrazone** (WOHL and SCHIFF), A., i, 707.
- Bisdiazomethane**. See Dihydratotetrazine.
- Bis-β-diethylidisulphonepropylthiocarbamide** (POSNER and FAHRENHORST), A., i, 16.
- Bismuth alloys** with sodium, composition and melting point of (KURNAKOFF), A., ii, 277.
- Bismuth salts**, action of sodium thiosulphate on (FAKTOR), A., ii, 692.
- Bismuth chloride**, double salts of, with organic bases (HAUSER and VANINO), A., i, 641.
- oxybromide, oxychloride, and oxyiodide (DE SCHULTEN), A., ii, 353.
- suboxide and subsulphide (SCHNEIDER), A., ii, 212.

- Bismuth, trioxide**, action of, on sulphur chloride (ODDO and SERRA), A., ii, 74.
- peroxide**, action of hydrogen sulphide on (VANINO and HAUSER), A., ii, 279.
- sulphates** (ADIE), P., 1899, 226.
- Bismuth organic compounds**:—
- compounds of, with phenols (RICHARD), A., i, 593.
- cobalticyanide (MILLER and MATHEWS), A., ii, 318; (MATHEWS), A., ii, 578.
- Bismuth, estimation and separation of**:—
- estimation of, electrolytically (BALACHOWSKI), A., ii, 578.
- separation of, from lead (CLARK), A., ii, 371.
- Bisnitrosocyclohexanonecarboxylic acid**, diethyl ester (DIECKMANN), A., i, 297.
- Bisnitrosocyclopentanonecarboxylic acid**, diethyl ester (DIECKMANN), A., i, 297.
- p-Bis-1-phenyl-3-methylpyrazoloneazobenzene** (BÜLOW), A., i, 261.
- Bisisopropylasimethylene**. See *iso-Butaldazine*.
- Dispulegone** (HARRIES and ROEDER), A., i, 183.
- Bitumen from Bohemia** (EICHLFITER), A., ii, 354.
- Bitumens**, estimation of sulphur in (S. F. and H. E. PECKHAM), A., ii, 44; (LANGMUIR), A., ii, 310.
- Bleaching powder**, estimation of chlorine in (WOLOWSKI), A., ii, 165.
- Blood**, electrical conductivity of (OKER-BLOM), A., ii, 290, 356, 607.
- specific heat of (BORDIER; BERTHELOT), A., ii, 356.
- relationship of constants of the (JELLINEK and SCHIFFER), A., ii, 152.
- changes in the composition of, after transfusion of sodium chloride, and their relationship to diuresis (MAGNUS), A., ii, 665.
- chemical changes in, from feeding with ammonium sulphate (RUMPF and SCHUMM), A., ii, 417.
- influence of the concentration of, on the tension of carbon dioxide in it (GRANDIS), A., ii, 604.
- influence of moisture on the passage of carbon dioxide from, to the air (GRANDIS), A., ii, 604.
- colouring matter of (NENCKI and ZALESKI), A., i, 709.
- changes in the ether-soluble substances in the (WEIGERT), A., ii, 738.
- hydroxyl-ions of the (HÖBER), A., ii, 738.
- Blood**, iodine in the (GLEY and BOURCET), A., ii, 555.
- oxygen in human (LOEWY), A., ii, 357.
- oxygen capacity and volume of, in man (HALDANE and SMITH), A., ii, 416, 665.
- volume and oxygen capacity of, in chlorosis and pernicious anemia (SMITH), A., ii, 416.
- the ferricyanide method of determining the oxygen capacity of (HALDANE), A., ii, 458.
- oxyhæmoglobin crystals from pigeons' (SCHWANTKE), A., i, 711.
- proteids of, action of lymphagogues on (TIMOFFEFFSKY), A., ii, 95.
- action of antileucocytic serum on the (DELEZENNE), A., ii, 423, 554.
- of mother and foetus, effect of ingested alcohol on the (NICLOUX), A., ii, 416.
- detection of (STRZYZOWSKI), A., ii, 123.
- detection of carbon monoxide in (IPSEN; WACHHOLZ), A., ii, 169.
- estimation of alcohol in, in acute alcoholism (GRÉHANT), A., ii, 95, 112.
- simultaneous estimation of two colouring matters in (HÜFNER), A., ii, 459.
- apparatus for the clinical estimation of phosphorus in (JOLLES), A., ii, 311.
- estimation of the reducing power of (ROSIN), A., ii, 319.
- estimation of uric acid and purine bases in (HIS and HAGEN), A., ii, 769.
- Blood corpuscles**, influence of, on the electrical conductivity of blood (OKER-BLOM), A., ii, 290, 356, 607.
- agglutination of, by chemical agents (HÉDON), A., ii, 665.
- red, and hæmolytic serum (CANTACUZÈNE), A., ii, 741.
- of animals, sodium and potassium in the (BOTTAZZI and CAPPELLI), A., ii, 225.
- Blood-formation**, relationship of iron to (ABDERHALDEN), A., ii, 223, 289, 416; (HOFMANN), A., ii, 491.
- Blood-gases**, action of the, on respiration (PLAVEC), A., ii, 238.
- Blood molasses**. See *Agricultural Chemistry*.
- Blood-pressure**, influence of minimal doses of suprarenal extracts on (MOORE and PURINTON), A., ii, 737.
- Blood-serum**, the anti-rennin of, in pathological conditions (ACHARD and CLERCQ), A., ii, 557.

Bocconia cordata, alkaloids of (MURRILL and SCHLOTTERBECK), A., i, 686.

Body, temperature of the, during fasting, and the speed of assimilation of carbohydrates, proteids, and fats (MOSSO), A., ii, 605.

Boiler water, influence of temperature and concentration on the saline constituents of (CRIBB), A., ii, 542.

Boiling point, relation between the melting point and, in hydrocarbons (BAYLEY), A., i, 369.

of mixtures of chloral and water (CHRISTENSEN), A., i, 626.

constant, of liquid mixtures (RYLAND), A., ii, 64.

increase in, of dilute solutions (SMITS), A., ii, 708.

of various substances (LADENBURG and KRÜGEL), A., ii, 258.

Boiling point apparatus (JONES), A., ii, 187; (BATELLI and STEFANINI), A., ii, 709.

Beckmann's, simplification of (BIGELOW), A., ii, 9.

for securing steady pressure during determinations (SMITS), A., ii, 388.

Boiling point curves of liquid mixtures (HAYWOOD), A., ii, 64; (SPEYERS), A., ii, 464.

Bone, mucin from (GIES), A., i, 317.

Bone meal. See Agricultural Chemistry.

Boragineæ, poisonous alkaloids of the (GREIMER), A., i, 683.

Borax. See Sodium baborate.

Borneol and *iso*Borneol, action of zinc dust on (SEMMLER), A., i, 351.

Borneols, sodium, action of aromatic aldehydes on (HALLER), A., i, 301.

Borneol, β -amino-, and its salts (DUDEN and MACINTYRE), A., i, 674.

Bornyl chloride and iodide, relation of, to pinene hydrochloride and hydriodide (WAGNER and BRICKNER), A., i, 46.

Bornylamine salts, and their molecular rotation (FORSER and HART-SMITH), T., 1152; P., 1900, 166.

Bornylene (WAGNER and BRICKNER), A., i, 554.

β -Bornylhydroxylamine (*1-hydroxyl-aminocamphane*) (FORSTER), T., 255; P., 1900, 14.

Bornylloxamide (FORSTER and HART-SMITH), T., 1155; P., 1900, 166.

Boron, atomic weight of (GAUTIER), A., ii, 14, 15; (HINRICHS), A., ii, 534, 539.

Boric acid, dissociation constant of (WALKER and CORMACK), T., 16; P., 1899, 208.

as a food preservative (RIDEAL and FOULERTON), A., ii, 560; (HEHNER), A., ii, 561.

Boron :—

Boric acid, esters of (WOHL and NEUBERG), A., i, 131.

qualitative test for (E. M. and M. L. WADE), A., ii, 758.

detection of, in borates (BORN-TRÄGER), A., ii, 439.

estimation of (JONES), A., ii, 47; (STOCK), A., ii, 312; (FISCHER), A., ii, 367; (WOLFF), A., ii, 435; (MORSE and HORN), A., ii, 626.

estimation of, in preserved meat and separation of, from borax (BEYTHIEN and HEMPEL), A., ii, 313.

estimation of, in tourmaline (SARGENT), A., ii, 47.

Borates, metallic (OUVRARD), A., ii, 206, 207.

Hyperborates, fluoro- (MELIKOFF and LORDKIPANIDZE), A., ii, 138, 139.

Brain, chemistry of the (BARBIERI), A., ii, 671.

Brandy, estimation of alcohols in (ADAM), A., ii, 53.

Brass, electrolytic deposition of (MORGAN), A., ii, 345.

Brasilein, constitution of (v. KOSTANECKI and FEUERSTEIN), A., i, 355.

Brasilin (GILBODY and PERKIN), P., 1899, 241.

constitution of (GILBODY, PERKIN, and YATES), P., 1900, 107; (v. KOSTANECKI and FEUERSTEIN), A., i, 355.

as a photographic developer (LEPETIT), A., ii, 519.

Bread-making, relation of the constituents of flour to (GUESS), A., ii, 584.

Breads, white and whole-meal, composition of, and digestion experiments with (ROSENHEIM and SCHIDROWITZ), A., ii, 289.

Brewery residues. See Agricultural Chemistry.

"Brilliant fast red G," synthesis of (KOHNER), A., i, 455.

Britholite from Greenland (WINTHER), A., ii, 413.

Bromal, compounds of, with formaldehyde (PINNER), A., i, 427.

Bromination by means of aluminium bromide (POURET), A., i, 369.

Bromine, spectrum of (EDER and VALENTA), A., ii, 330.

vapour density of, at high temperatures (PERMAN and ATKINSON), A., ii, 398.

action of, on phenol and cresols (DITZ and CEDIVODA), A., ii, 54.

physiological action of (FESSEL), A., ii, 227.

- Bromine compounds**, effect of very low temperatures on the colour of (KASTLE), A., ii, 528.
- Hydrobromic acid** (*hydrogen bromide*), preparation of pure (SCOTT), T., 648; P., 1900, 69.
- influence of, on the bromination of trimethylene (GUSTAVSON), A., i, 535.
- Bromates and hypobromites**, formation of, by the electrolysis of the bromides of the alkaline earth metals (SARGHEL), A., ii, 400.
- Hypobromous acid**, action of, on anilides (CHATTAWAY and ORTON), T., 789, 797; P., 1900, 102, 112; (CHATTAWAY, ORTON, and HURLEY), A., i, 152; (ARMSTRONG), T., 1047; P., 1900, 160.
- action of, on diacetyl-*m*-phenylenediamine (MORAN), T., 1203; P., 1900, 170.
- action of, on unsaturated acids (MELIKOFF), A., i, 536.
- Bromine, estimation and separation of**—
- estimation of, in presence of chlorine and iodine (v. WESSELSZKY), A., ii, 436.
- separation of, from chlorine and iodine (CROTOGINO), A., ii, 642.
- Bromoform**, action of, on dimethylpyrrolines (BOCCHI), A., i, 357.
- compound of, with aluminium bromide and carbon disulphide (KONOWALOFF and PLOTNIKOFF), A., i, 323.
- Bronzes from Ephesus**, composition of (NATTERER), A., ii, 480.
- analysis of (FOMIN), A., ii, 109.
- Bullocks**. See Agricultural Chemistry.
- Burette for gas analysis** (WHITE), A., ii, 571.
- Burettes**, use of floats in (KREITLING), A., ii, 685.
- isoButaldazine** (*bisisopropylazimethylene*), transformation of, into 4:4-dimethyl-5-isopropylpyrazoline (FRANKE), A., i, 212.
- isoButaldehyde** and formaldehyde, an aldol from (WESSELY), A., i, 428.
- condensation of, with acetone (FRANKE and KOHN), A., i, 206.
- condensation of, with furfuraldehyde (LINDAUER), A., i, 305.
- condensation of, with glyoxal (v. HORNPOSTEL and SIEBNER), A., i, 206.
- isoButaldehyde**, α -bromo- (2-methyl-2-bromopropional) (FRANKE), A., i, 428.
- p*- α -bromo- (mono- and tri-meric) (FRANKE), A., i, 427.
- isoButane**, dinitro-, and its potassium derivative (PONZIO), A., i, 588.
- Butanedicarboxylic acids**. See:—
- Adipic acid.
- Dimethylsuccinnic acid.
- Methylglutaric acid.
- Propylmalonic acid.
- cycloButanedicarboxylic acid** (*cis-tetramethylene-1:3-dicarboxylic acid*), formation of (BOTTOMLEY and PERKIN), T., 306; P., 1900, 16.
- Butanetetra-carboxylic acid**, α -*di*-bromo-, ethyl ester (LEAN), T., 103; P., 1899, 197.
- Butanol mercury salts** and **Butene-mercury iodide** (SAND and HOFMANN), A., i, 386.
- Butinene α -*di*-bromide** (THIELE), A., i, 2.
- Butter**, rancidity of (BROWNE), A., ii, 115; (HANUS), A., ii, 634.
- detection of normal and "renovated" (HUMMEL), A., ii, 582.
- detection of "process" or "renovated" (HESS and DOOLITTLE), A., ii, 452.
- analysis of (RICHMOND), A., ii, 696.
- and its substitutes, analysis of (INDEMAN), A., ii, 115.
- refractometric value of (LAM), A., ii, 634.
- analysis of, refractometrically (PARTHEIL and v. VEISEN), A., ii, 633.
- detection of cotton-seed oil in (VAN ENGELEN; SOLTSIEN), A., ii, 116; (STRYZOWSKI), A., ii, 325.
- detection of sesame oil in (WEIGMANN), A., ii, 40; (SOHN), A., ii, 55; (KERP), A., ii, 116; (BREMER; SOLTSIEN), A., ii, 325; (AMTHOR), A., ii, 453.
- estimation of the volatile acids in, by Leffmann-Beam's glycerol-soda process (SEYDA), A., ii, 772.
- errors in the estimation of insoluble fatty acids in (MAINSBRECQ), A., ii, 114.
- estimation of fat in, by Gerber's process (WERDER), A., ii, 252.
- the Reichert number of fat in (STEBINS), A., ii, 55.
- See also Agricultural Chemistry.
- n-Butyl isocyanide** (WADE), P., 1900, 157.
- isoButyl nitrite**, action of ethyl alcohol and alcoholic hydrogen chloride on (KISSEL), A., i, 621.
- phosphates and their lead and barium salts (CAVALIER and PROST), A., i, 579.
- tert. Butyl isocyanide** (NER), A., i, 4.

*iso*Butylbenzene, preparation and properties of (PERKIN), T., 288; P., 1899, 237.

*sec.*Butylbenzene and its *p*-sulphonic acid (ESTREICHER), A., i, 213.

4-*tert.*Butylcoumarone (STOERMER), A., i, 653.

Butyleytisine platinichloride, *iso*- and *sec.*- (LITTERScheid), A., i, 513.

Butylene, action of, on mercuric salts (SAND and HOFMANN), A., i, 385.

Butylenedicarboxylic acid. See Dimethylfumaric acid.

*iso*Butylideneacetone, its oxime and acetyl derivative (FRANKE and KOHN), A., i, 206.

*p-sec.*Butylphenol and its acetyl derivative (ESTREICHER), A., i, 213.

5-Butylisophthalic acid, 2-nitro- (BAUR-THURGAU), A., i, 640.

Butyltoluenes. See Methylbutylbenzenes.

Butyltoluic acid, *dinitro*- (BAUR-THURGAU), A., i, 640.

5-Butyl-*p*-toluic acid (BAUR-THURGAU), A., i, 640.

Butylxylene (1:3-*dimethyl-5-butylbenzene*), and its derivatives (BAUR-THURGAU), A., i, 639.

Butylxylidine ($\text{Me}_2\text{C}_4\text{H}_9\text{NH}_2=1:3:5:2$), and its benzylidene and acyl derivatives, salts, and 4-*mono* and 4:6-*dinitro*- and their acetyl derivatives (BAUR-THURGAU), A., i, 639.

($\text{Me}_2\text{C}_4\text{H}_9\text{NH}_2=1:3:5:4$), and its salts and benzoyl derivative (BAUR-THURGAU), A., i, 640.

Butylxylid cyanide, and its *dinitro*-derivative ("cyanide musk"), structure of (BAUR-THURGAU), A., i, 640.

Butylxylaldehyde and its oxime (BAUR-THURGAU and BISCHLER), A., i, 178; (BAUR-THURGAU), A., i, 640.

Butylxylid methyl ketone, structure of (BAUR-THURGAU), A., i, 640.

*iso*Butyralacetone and its oxime (FRANKE and KOHN), A., i, 207.

Butyric acid, α -amino- (v. GULEWITSCH), A., i, 476.

d- and *l*- α -amino-, and their hydrochlorides (FISCHER and MOUNEY-RAT), A., i, 648.

γ -amino-, and its salts (TAFEL and STERN), A., i, 557.

β - and γ -chloro-, preparation of, and action of water on (DE BARR), A., i, 76.

γ -cyano- (DIECKMANN), A., i, 297.

*iso*Butyric acid, *o*-nitrophenyl ester (BISCHOFF), A., i, 442.

*iso*Butyric acid, α -bromo-, ethyl ester, condensation of, with ethyl malonates and ethyl cyanoacetates (LAWRENCE), P., 1900, 154.

α -iodo- (ZERNOFF), A., i, 328.

Butyric acids, *n*- and *iso*-, density of (v. HIRSCH), A., ii, 9.

α -thiocyano-, esters of, formation and boiling points of (WHEELER and BARNES), A., i, 565.

estimation of, in acetic acid (MUSPRATT), A., ii, 375.

separation of, from lactic and valeric acids (SCHNEIDER), A., ii, 177.

*p-iso*Butyroxyl- ψ -cumyl, and -mesityl ethyl ether and bromide, *di*bromo- (AUWERS, TRAUN, and WELDE), A., i, 169.

p-n-Butyryl-acetanilide, and -aniline (KUNCKELL), A., i, 665.

*iso*Butyrylactic and Butyrylacetacetic acids, ethyl esters, and *iso*Butyryl-acetone, synthesis of (BOUVEAULT), A., i, 474.

Butyryl-*o*-flavaniline (CAMPS), A., i, 310.

C.

Cacodylic acid, heat of neutralisation and acidimetry of (IMBERT), A., i, 145.

sodium salt, elimination of, in urine, after ingestion (IMBERT and BADEL), A., ii, 293.

estimation of, volumetrically (IMBERT and ASTRUC), A., ii, 122.

Cadinene from West Indian sandalwood oil (DEUSSEN), A., ii, 579.

nitroso-derivatives of (SCHREINER and KREMER), A., i, 106.

Cadmium, colloidal (BREDIG), A., ii, 278.

boiling point of (BERTHELOT), A., ii, 654.

Cadmium alloys with platinum (HODGKINSON, WARING, and DEBOROUGH), A., ii, 282.

with sodium, composition and melting point of (KURNAKOFF), A., ii, 277.

Cadmium amalgam (KERF and BÖTTGER), A., ii, 656.

Cadmium orthoborate (OUVRARD), A., ii, 206.

haloids, compounds of, with the methylamines and tetramethylammonium (RAGLAND), A., i, 141.

hydroxide, equilibrium in the partition of an acid between ammonia and (HERZ), A., ii, 532.

iodide, combination of, with ammonia in aqueous solution (DAWSON and McCRAE), T., 1246; P., 1900, 173.

trihydrated acid (DOBROSERDOFF), A., ii, 654.

- Cadmium ammonium phosphate**, estimation of cadmium in (AUSTIN), A., ii, 49.
- selenide, dimorphism of (FONZES-DIACON), A., ii, 346.
- ferrous sulphates, solubility of (STORTENBEKER), A., ii, 530.
- vanadinites, production of (DE SCHULTEN), A., ii, 346.
- Cadmium organic compounds**:—
- ferrocyanide (MILLER and FISHER), A., ii, 761.
- Cadmium, estimation of**:—
- estimation of, electrolytically (BALACHOWSKI), A., ii, 688.
- estimation of, gravimetrically (HESS), A., ii, 688.
- estimation of, in cadmium ammonium phosphate (AUSTIN), A., ii, 49.
- estimation of, in zinc (MACKAY), A., ii, 49.
- Cæsium**, preparation of, from the carbonate (GRAEFE and ECKARDT), A., ii, 75.
- physical properties of (ECKARDT and GRAEFE), A., ii, 479.
- Cæsium salts**, extraction of, from lepidolite (FORMÁNEK), A., ii, 15.
- Cæsium chloride**, compound of, with manganese chloride (MEYER and BEST), A., ii, 77.
- fluoroperoxide and hydrogen tetrafluoriodate (WEINLAND and KÜPPEN), A., ii, 139.
- persulphate (KURNAKOFF), A., ii, 277.
- Cæsium, detection of**:—
- microchemical detection of (HUYSE), A., ii, 245.
- Caffeine**, electrolytic reduction of (TAFEL), A., ii, 588.
- action of iodine on (KIPPENBERGER), A., ii, 777.
- action of, on the heart (BOCK), A., ii, 424.
- decomposition of, in the organism (KRÜGER), A., ii, 30, 93.
- influence of, on the output of alkalis in the urine (KATSUYAMA, KUWAHARA, and SENO), A., ii, 94.
- delicate test for (ARCHETTI), A., ii, 121.
- Caffeineazo-compounds** (GOMBERG), A., i, 264.
- Cakes, feeding**. See Agricultural Chemistry.
- Calcite and aragonite**, physicochemical relations of (FOOTE), A., ii, 541.
- Calcium and its compounds** (MOISSAN), A., ii, 76.
- metabolism of (LEIPZIGER), A., ii, 223.
- Calcium salts**, solubility of, in sucrose solutions (STOLLE), A., i, 333.
- Calcium salts**, colour reactions for detecting, in organic tissues (GRANDIS and MAININI), A., ii, 625.
- Calcium aluminates** (ALLEN and ROGERS), A., ii, 727; (DUPAU), A., ii, 728.
- boride, formation of (GEELMUYDEN), A., ii, 344.
- bromide, electrolysis of solutions of (SARGHEL), A., ii, 401.
- carbide, commercial (MOISSAN), A., ii, 15.
- action of amyl chloride on (LEFEBVRE), A., i, 323.
- reducing action of (GEELMUYDEN), A., ii, 344.
- analysis of (ERDMANN and V. UNRUH; MAGNANINI and VAN NINI), A., ii, 511.
- carbonate, solubility of, in sea water (COHEN and RAKEN), A., ii, 725.
- action of, on phosphoric acid (SCHLÖSING), A., ii, 541, 618.
- estimation of, in marls (NOLL), A., ii, 48.
- chloride, combination of, with ammonia in aqueous solution (DAWSON and McCRAE), T., 1249; P., 1900, 173.
- hydroxide, action of, on germination (WINDISCH), A., ii, 614.
- oxide (in three forms), solubility of, in sugar solutions (WEISBERG), A., i, 628.
- oxide (*lime*), action of hydrogen peroxide on (DE FORCRAND), A., ii, 526.
- See also Agricultural Chemistry.
- peroxide, heat of formation of (DE FORCRAND), A., ii, 526.
- anhydrous, and the constitution of its hydrates (DE FORCRAND), A., ii, 479.
- peroxides, hydrated (DE FORCRAND), A., ii, 401.
- phosphate, preparation of (PRUNIER and JOUYE), A., ii, 140.
- Tricalcium phosphate**, solubility of, in natural waters in presence of carbonic acid (SCHLÖSING), A., ii, 541, 618.
- Calcium phosphates**. See also Agricultural Chemistry.
- orthoplumbate* and *perplumbate* (KASNER), A., ii, 725.
- sulphate, hydrates of (VAN'T HOFF and ARMSTRONG), A., ii, 531.
- See also Gypsum.
- hydroximidiosulphate, production of (DIVERS and HAGA), T., 690; P., 1900, 71.

- Calcium, detection, estimation, and separation of:—**
 detection of barium, strontium, and (DUMESNIL), A., ii, 625.
 estimation of, by the citrate method (PASSON), A., ii, 246.
 estimation of, in presence of aluminium and iron (BLUM), A., ii, 511.
 estimation of, photometrically, in limestone (HINDS), A., ii, 575.
 separation of barium, strontium, and (KÜSTER), A., ii, 108.
- Calorimeter, a new coal (PARR), A., ii, 710.**
 Bunsen's ice (MELLOR), A., ii, 334.
Calves. See Agricultural Chemistry.
- 2-Camphanamine, chloro- (DUDEN and MACINTYRE), A., i, 302, 674.**
- Camphane, 1-nitro-, ψ -nitro- and its potassium and benzoyl derivatives, 1:1-bromonitro-, 1:1-chloronitro-, and 1:1-iodonitro- (FORSTER), T., 251; P., 1900, 13.**
- i*-Camphane (ASCHAN), A., i, 399.**
- Camphanic acid, isomeride of (PERKIN and THORPE), P., 1900, 152.**
- Camphenamine, the vinylamine constitution of, and the action of methyl iodide and benzaldehyde on (DUDEN and MACINTYRE), A., i, 302.**
 and the action of nitrous acid on it and its salts (DUDEN and MACINTYRE), A., i, 674.
- Camphene (WAGNER and BRICKNER), A., i, 47, 554.**
 from borneol (SEMMLER), A., i, 351; (KONOWALOFF), A., i, 352.
 constitution of, and action of fuming nitric acid on (BOUVEAULT), A., i, 508.
- Camphenepyrroles, synthesis of (DUDEN and TREFF), A., i, 671.**
- Camphenilaldehyde and *n*- and *iso*-Camphenilanic acids (BREDT and JAGELKI), A., i, 134.**
- iso*-Camphenone, constitution of (RIMINI), A., i, 554.**
- Camphenylone and its oximes (BLAISE and BLANC), A., i, 183.**
- Campherimine, decomposition products of (MAHLA and TIEMANN), A., i, 507.**
- ψ -Campholactone and its isomeride (LEES and PERKIN), P., 1900, 18.**
- Campholene, α -amino- (BLANC), A., i, 581.**
- Campholic acid, and bromo-, synthesis of, by means of camphoric acid (v. BAEYER and VILLIGER), A., i, 133; (HALLER and BLANC), A., i, 202.**
- Campholide (v. BAEYER and VILLIGER), A., i, 133.**
- Campholide, α -bromo-, its formula and hydrolysis (LAPWORTH and CHAPMAN), T., 446; P., 1900, 56.**
*di*bromo- (LAPWORTH and CHAPMAN), T., 310; P., 1900, 4.
- Campholytic acid and its stereoisomeride, reactions and structure of (WALKER and CORMACK), T., 374; P., 1900, 58.**
 constitution of (BLANC), A., i, 581; (NOYES and PHILLIPS), A., i, 622.
- Camphonic acid, its oxime, semicarbazone, and phenylhydrazones, and action of bromine and of hydrogen cyanide on (LAPWORTH and CHAPMAN), T., 446; P., 1900, 56.**
- Camphonolactone, *mono*- and *tri*-bromo- (LAPWORTH and CHAPMAN), T., 446; P., 1900, 56.**
- Camphononic acid, formation of (LAPWORTH), T., 1070.**
 action of bromine and hydrogen cyanide on, and its oxime (LAPWORTH and CHAPMAN), T., 452; P., 1900, 57.
- Camphopyric acid and anhydride, bromo-derivatives of (GARDNER), P., 1900, 46.**
- Camphor, constitution of (LAPWORTH), T., 1053; P., 1900, 128; (BOUVEAULT), A., i, 182.**
 vapour pressure of (ALLEN), T., 413; P., 1899, 413.
 solubility of, in hydrochloric and hydriodic acids (ZAHARIA), A., i, 106.
 oxidation of, by an alkali ferricyanide (ETARD), A., i, 301.
 aromatic compounds of, molecular refraction and dispersion, and specific rotation of (HALLER and MÜLLER), A., i, 182.
 derivatives, molecular volume of (HALLER and MÜLLER), A., ii, 193.
 spirit of, valuation of (PARTHEIL and VAN HAAREN), A., i, 507.
 estimation of, polarimetrically, in camphorated oil (LEONARD and SMITH), A., ii, 699.
- Camphor, α -*di*bromo-, action of fuming nitric acid on (LAPWORTH and CHAPMAN), T., 309; P., 1900, 4.**
 $\alpha\alpha'$ -bromonitro- (LAPWORTH and CHAPMAN), T., 310; P., 1900, 4.
 cyano-, and its chloro- and bromo-derivatives and their hydrolysis (LAPWORTH), T., 1053; P., 1900, 128.
- iso*Camphor, constitution of (RIMINI), A., i, 554.**
- β -*iso*Camphor and its phenylurethane (DUDEN and MACINTYRE), A., i, 674**

- Camphordioximes** (ANGELICO), A., i, 675.
- Camphorenic acid**, bromo-, formula of (LAPWORTH and CHAPMAN); T., 446; P., 1900, 56.
- Camphoric acid** (BALBIANO; NOYES), A., i, 202.
constitution of (WALKER), T., 390; P., 1900, 60.
experiments on the synthesis of (PERKIN and THORPE), P., 1900, 152.
esterification of (WEGSCHEIDER), A., i, 10.
- l*-isoCamphoric acid** and its ethyl esters (WALKER and WOOD), T., 383; P., 1900, 59.
- Camphoric acids**, configuration of (WALKER and WOOD), T., 383; P., 1900, 59; (WALKER), T., 395; P., 1900, 61.
- Camphoric anhydride**, action of aluminum chloride on (LEES and PERKIN), P., 1900, 18; (BLANC), A., i, 133, 586.
- Camphorone**, synthesis of, and its oxime and tribromo-derivative (BOUVEAULT), A., i, 207.
- Camphoronic acid**, formation of (LAPWORTH), T., 1071.
- iso*Camphoronic acid** (MAHLA and TIEMANN), A., i, 507.
- Camphoroxalic acid** and its condensation with amines (J. B. and A. TINGLE), A., i, 802.
- Camphoroxime**, compound of crystals of optical isomerides of (ROOZEBOOM), A., ii, 70.
- Camphoroximeacetic acid** and its sodium and borylamine salts (FORSTER and HART-SMITH), T., 1154; P., 1900, 166.
- Camphorsemicarbazone** (RIMINI), A., i, 555.
- Canadic, α - and β -Canadinolic, and Canadolic acids and Canadoren** (TSCHIRCH and BRÜNING), A., i, 678.
- Cane-sugar**. See Sucrose.
- "Cannel powder,"** a new explosive (ALVIST), A., ii, 205.
- Caoutchouc (indiarubber)**, constituents of (WEBER), A., i, 353.
wares, analysis of (HENRIQUES), A., ii, 124; (CHÉNEAU), A., ii, 639.
- Capillarity**, theory of (BAKKER), A., ii, 466.
- Caproic acid**. See Hexoic acid.
- Capronaldazine** (FRANKE), A., i, 213.
- Capsaicin**, reactions of (MICKO), A., ii, 58.
- Caramel** and its acetyl and benzoyl derivatives (STOLLE), A., i, 209.
- Caramel**, estimation of, spectroscopically, in aqueous solutions (STOLLE), A., ii, 249.
- Caranna resin**, examination of (DIETERICH), A., ii, 118.
- Carbamic chloride**, action of, on β -acetylphenylhydrazines (RUPE and LABHARDT), A., i, 258.
- Carbamide (urea)**, preparation of, from guanidine (FLEMMING), A., i, 280.
rate of formation of, from solid ammonium cyanate (WALKER and WOOD), T., 30; P., 1899, 209.
See also Urea.
- o*-Carbamides** (MENNE), A., i, 286.
- iso*Carbamides**, oxygen ethers of (STIEGLITZ and MCKEE), A., i, 340, 431.
- Carbamides**, substituted, action of acid reagents on (DAINS), A., i, 390.
thio-. See Thiocarbamides.
- Carbaminocamidines** (WHEELER and SANDERS), A., i, 563.
- Carbaminothioglycollic acid** (WHEELER and BARNES), A., i, 565.
- Carbanilide**. See Diphenylcarbamide.
- Carbanilinoamino-diphenyl- and ditolyl-guanidine**, thio- (BUSCH and BAUER), A., i, 414.
- Carbaniloisobutyric acid**, α -thio-, ethyl ester (WHEELER and BARNES), A., i, 565.
- Carbasides**, preparation of (CAZENETTE and MORREAU), A., i, 196.
- Carbethoxythiocarbamic acid**, ethyl ester, action of phenylhydrazine on (WHEELER and SANDERS), A., i, 564.
- Carbimides**, aromatic, action of alcohol on (VITTENET), A., i, 154.
thio-. See Thiocarbimides.
- Carbiminothioglycollic acid, diamino-** (HARRIES and KLAMT), A., i, 413.
- Carbindigo** (GABRIEL and COLMAN), A., i, 359.
- Carbodiphenylimide**, additive products of (TRAUBE and EYME), A., i, 118.
- Carbohydrates** from the albumen of the seed of the American bean (GORET), A., ii, 562.
from *Buonymus japonicus* (MAQUENNE), A., ii, 161.
in lucerne and fenugreek seeds (BOURQUELOT and HÉRISSEY), A., ii, 233, 301.
in the St. Ignatius bean and nuxvomica (BOURQUELOT and LAURENT), A., ii, 498, 611.
action of hydrogen peroxide on, in presence of ferrous salts (MORRELL and CROFTS), T., 1219; P., 1900, 171.
speed of assimilation of, during fasting (MOSSO), A., ii, 605.

Carbohydrates, behaviour of, in the body
(CHARRIN and GUILLEMONAT), A.,
ii, 606; (MÜNCH), A., ii, 607.
elimination of, in urine (ROSENFELD),
A., ii, 358.
nutritive value of, for denitrifying
organisms (STOKLASA), A., ii, 98.
digestion of, by *Aplysia* (RÖHMANN),
A., ii, 289.
phenylosazones of, purification and
rotatory power of (NEUBERG), A.,
i, 139.

carbohydrates. See also :—

Achroodextrin
Acroses.
Amylogen.
Arabinose.
Astragalose.
Bassorin.
Cane sugar (*sucrose*).
Cellulose.
Dextran.
Dextrin.
Dextrose (*glucose*).
Dulcitol.
Erythritols.
Erythroese.
Erythrulose.
Fucose.
Galactan.
Galactosarabinose.
Galactosamine.
Galactose.
d-Glucose (*dextrose*).
l-Glucose.
Glycogen.
Hemicelluloses.
Iditola.
Inulin.
Lactose.
Lævulomannan.
Lævulose (*fructose*).
Lyxose.
Maltodextrin.
*iso*Maltose.
Mannitol.
Mannocellulose.
Mannogalactan.
Mannose.
Melibiose.
Melitriose (*raffinose*).
Methyleneglucose.
Methylpentosans.
Methylpentoses.
Methylstrophanthobioside.
Orycelluloses.
Pentoses.
Pentosans.
Raffinose.
Rhamninite.
Rhamninose.
Rhamnose.

Carbohydrates. See :—

Rhodoese.
Saccharose (*sucrose*).
Sorbinoese (*sorbose*).
Sorbitol.
Starch.
Sucrose (*cane sugar*).
 ψ -Tagatose (*l-sorbinose*).
Trehalose.
Xylose.

Carbon, the molecule of (VAUBEL), A.,
ii, 274.

electrochemical equivalent of (PEASE),
A., ii, 257; (SKINNER), A., ii, 523.
amorphous, as a compressed powder,
electrical conductivity of (STRE-
INTZ), A., ii, 641.

Carbon alloys with iron, Osmond and
Roberts-Austen's theory of (HRYN),
A., ii, 557.

Carbon tetrachloride, preparation of
(SERRA), A., i, 74.

boiling point of, with mixture of
benzene and methyl alcohol (HAY-
WOOD), A., ii, 64.

Carbon monoxide (*carbonic oxide*) and
oxygen, influence of the nascent
state on the combination of dry
(RUSSELL), T., 361; P., 1900, 42.

supposed oxidation of, in the
organism (HALDANE), A., ii, 221.

in tobacco smoke, effect of, on the
organism (WAHL), A., ii, 221.

detection of, in blood (IPSEN;
WACHHOIZ), A., ii, 169.

iodometric estimation of small
quantities of (KINNICUT and
SANFORD), A., ii, 314.

Carbon dioxide (*carbonic anhydride*),
heat of vaporisation of (BEHN),
A., ii, 260.

specific heat of (AMAGAT), A., ii, 525.
dissociation constant of (WALKER and
CORMACK), T., 8; P., 1899, 208.

deviation from Boyle's law of mixtures
of hydrogen and (VERSCHAFFELT),
A., ii, 192.

invasion and evasion coefficients of, in
alcohol and water (BOHR), A., ii, 267.

liquid, analysis of, in cylinders
(HOLSTE), A., ii, 623.

action of, on barium borates (MORSE
and HORN), A., ii, 626.

elimination of, during respiration
(GRANDIS), A., ii, 604.

influence of moisture on the passage
of, from the blood to the air
(GRANDIS), A., ii, 604.

estimation of (SCHALLER), A., ii, 48.

estimation of, in the atmosphere
(WALKER), T., 1110; P., 1900, 164;

(LETTIS and BLAKE), A., ii, 622.

- Carbon dioxide** (*carbonic anhydride*), rapid estimation of, in gaseous mixtures (VIGNON and MEUNIER), A., ii, 314.
 estimation of, in carbonates (DIVINE), A., ii, 686.
 estimation of, in ammoniacal gas-liquor (CHEVALEUR), A., ii, 170.
 apparatus for the estimation of, in mineral waters (HELD), A., ii, 169.
 estimation of, in soils (SCHÜTTE), A., ii, 48.
 Stutzer and Hartleb's method for the estimation of combined, in soils (WOY), A., ii, 170.
- Carbon disulphide**, compounds of, with bromo-derivatives of ethane and aluminium bromide (KONOWALOFF and PLOTNIKOFF), A., i, 323.
 effect of, on soil organisms (WOLLNY), A., ii, 504.
 estimation of (RUSSELL), T., 359; P., 1900, 41.
- Carbon**, estimation of—
 estimation of, in iron (FORD and BRZGOWSKY), A., ii, 168; (HERTING), A., ii, 245.
 estimation of, in iron or steel (SARGENT; AUCHY; BLOUNT), A., ii, 574.
 estimation of, in iron or steel, treatment of copper potassium chloride for the (SARGENT), A., ii, 440.
- Carbonyl chloride**, action of, on aromatic bases (VITTENET), A., i, 153.
 sulphide, estimation of (RUSSELL), T., 356; P., 1900, 41.
- Carbonylhydroferrocyanic acid** and hydroferrocyanic acid, comparison of heat of fractional neutralisation of (MULLER), A., ii, 130.
- Carbonylmethylaminophenol** (RANSOM), A., i, 219.
- isocarbostryl**, and the formation of its derivatives (GABRIEL and COLMAN), A., i, 358.
- Carboxylaminophenols**, dibromo- (VAN DAM), A., i, 171.
- α -Carboxyphenoxy-propionic**, *n*- and *iso*-butyric, and *isovaleric* acids, *m*- and *p*-, and their ethyl esters (BISCHOFF), A., i, 397.
- α -Carboxyphenylglycollic acid**, anilide, phenetide, and aniside of (COHN), A., i, 93.
- Carmin**, α - and β -bromo-, and **Carminic acid** and its derivatives (LIEBERMANN, HÜRING, and WIEDERMANN), A., i, 236.
- Carnallite**, equilibrium relations of (VAN'T HOFF and MEYERHOFFER), A., ii, 12.
- Carnallites**, production of substituted (DE SCHULTEN), A., ii, 343.
- Carnosine** from meat extract (v. GULEWITSCH and AMIRADŽIĆ), A., i, 516.
- Carnotite** from West Colorado (HILLEBRAND and RANSOME), A., ii, 599.
- Carob bean seeds**, enzyme of (BOURQUELOT and HÉRISSEY), A., i, 320; ii, 35, 233.
- Caro's acid** or **Caro's reagent** (BACH), A., ii, 470; (BAMBERGER), A., ii, 536.
 preparation of, and action of permanganate on (v. BAEYER and VILLIGER), A., ii, 719.
 oxidation of aliphatic amines, and of aromatic iodides by (BAMBERGER and HILL), A., i, 281.
 action of, on furfuraldehyde (CROSS, BEVAN, and BRIGGS), A., i, 682.
 action of, on ketones (v. BAEYER and VILLIGER), A., i, 133, 206, 328, 627.
 action of, on oximes (BAMBERGER), A., i, 500.
 See also Persulphuric acids under Sulphur.
- Carpaine**, action of phenylthiocarbimide on (LITTSCHNEID), A., i, 516.
- Carpic acid**, bromo- (PINNER and KOHLHAMMER), A., i, 456.
- Carthamus tinctorius***, oil of (*safflower oil*) (LE SUEUR), A., ii, 362.
- Cartilage**, fat in (SACERDOTTI), A., ii, 291.
 sodium in (v. BUNGE), A., ii, 92.
 of the shark, composition of (v. BUNGE), A., ii, 29.
- Carvacrol**, sodium derivative, compounds of, with the ethyl esters of α -bromo- fatty acids (BISCHOFF), A., i, 394.
 bromo- and chloro-amino-, diacetyl derivatives of (KEHRMANN and SCHOEN), A., i, 181.
- α -Carvacroxy-propionic**, *n*- and *iso*-butyric, and *isovaleric* acids and their ethyl esters (BISCHOFF), A., i, 394.
- Carvacryl-acetal**, and *acetaldehyde* and its semicarbazone (STOERMER), A., i, 653.
- Carvenone** from dihydrocarvone (KONDAKOFF and LUTSCHININ), A., i, 104; (KLAGES), A., i, 239.
- Carvomenthene** and **Carvomenthol** and their derivatives (KONDAKOFF and LUTSCHININ), A., i, 104.
- Carvone**, conversion of, into limonene (TSCHUGAEFF), A., i, 352.
 dichloride and its reactions (KLAGES and KRAITH), A., i, 43.

Carvone, estimation of, in volatile oils (LABBÉ), A., i, 398; (ALDEN and NOLTE), A., ii, 117; (ALDEN and EHLERT), A., ii, 631.

Carvones, ψ - and σ -, formulæ of (SEMMER), A., i, 453.

Carvonedihydrodisulphonic acid (LABBÉ), A., i, 398.

Carvotanacetone, constitution of (SEMMER), A., i, 676.

α -Carvoxime, nature of (ROOZEBOOM), A., i, 240.

Caryophyllene and its nitroso-derivatives (SCHREINER and KREMERS), A., i, 106.

Cascarilla oil, constituents of (THOMS), A., i, 622.

Cascarillic acid and its amide, and the action of nitric acid on (THOMS), A., i, 622.

Casein, decomposition of, by sulphuric acid (KUTSCHER), A., i, 67.

Caseinogen of human milk (KOBRAK), A., ii, 420.

Cassiterite from Banca and Billiton (BECK), A., ii, 734.

analysis of (MENNICKE), A., ii, 761.

Cat, nitrogenous metabolism in the (MENDEL and BROWN), A., ii, 151.

Catalysis. See Affinity, chemical.

Catechobis- α -oxy-propionic, n - and \textit{iso} -butyric, and $\textit{isovaleric}$ acids, their ethyl esters and lactones (BISCHOFF), A., i, 445.

Catecho-mono- and bis-oxypropionyl-p-phenetides (BISCHOFF), A., i, 445.

Catechol (*pyrocatechol*: 1:2-dihydroxybenzene), action of picryl chloride on (HILLYER), A., i, 289.

condensation of the disodium derivative of, with esters of α -bromo-fatty acids (BISCHOFF), A., i, 445.

derivatives (MOUREU), A., i, 99.

Catechol-acetanilide, -methylanilide, -piperidide, -phenylhydrazide, and -p-toluidide (LUDEWIG), A., i, 444.

Catecholacetic acid (α -hydroxyphen-oxyacetic acid), and its ethyl ester, anhydride and anilide (CARTER and LAWRENCE), T., 1222; P., 1900, 152.

and its esters and anhydride, and acetyl and bromo- and nitro-derivatives (LUDEWIG), A., i, 444.

Catecholcarbobenzylisoamylamine (EINHORN and PFEIFFER), A., i, 222.

Cattle. See Agricultural Chemistry.

Ceanothus americanus, alkaloids of (GORDIN), A., i, 683.

Cedron, $\text{C}_{16}\text{H}_{18}\text{O}_4$ or $\text{C}_{14}\text{H}_{16}\text{O}_5$, its acetyl derivative and methyl ether (ČRČELSKY), A., i, 225.

Celadonite from Moravia (KOVÁK), A., ii, 149.

Celestite from Baltschiederthal, Switzerland (SCHMIDT), A., ii, 217.

Cells, galvanic. See Electrochemistry.

Cellulose, does, occur in the shield of Sepia? (SCHULZ), A., ii, 292.

molecular weight of (NASTUKOFF), A., i, 540.

specific heat of (FLEURY), A., ii, 188.

fermentation of (OMELIANSKY), A., ii, 493.

enzymes (NEWCOMBE), A., ii, 99.

acetyl derivatives of (FRANCHIMONT), A., i, 141; (VIGNON and GERIN), A., i, 629.

nitrates (LUCK and CROSS), A., i, 541; (VIGNON), A., i, 589.

reduction of (VIGNON), A., i, 629.

estimation of (BECK; KÖNIG), A., ii, 448; (COUNCLER), A., ii, 630.

estimation of, in feces (MANN), A., ii, 250.

estimation of, in plants (KLEIBER), A., ii, 630.

Cell-wall constituents, estimation of, in plants (KLEIBER), A., ii, 630.

Cements, change of volume of, during hydration (LE CHATELIER), A., ii, 140.

testing of (KLEIN and PECKHAM), A., ii, 627.

Cereals. See Agricultural Chemistry.

Cerebrin (*phrenosin*), reactions of (THURDICHUM), A., i, 319.

Cerebro-spinal fluid, composition of (PANZER), A., ii, 152.

absence of cholinein (v. GULEWITSCH), A., ii, 420.

Cerite metals, preparation of the sulphur, bromine and chlorine compounds of (MUTHMANN and STÜTZEL), A., ii, 142.

See also Earths, rare.

Cerium salts, oxidation of, in alkaline solution (JOB), A., ii, 657.

Cerium, double nitrates of quadrivalent (MEYER and JACOBY), A., ii, 597.

oxide (*ceria*), luminosity of mixtures of thoria and (THIELE), A., ii, 208.

sulphates (MUTHMANN and STÜTZEL), A., ii, 544.

estimation of (BROWNING), A., ii, 170; (v. KNORRE), A., ii, 576.

separation of, from the cerite earths (WITT and THEEL), A., ii, 403.

Cerussite from the Altai (v. JEREMÉEFF), A., ii, 354.

Cetipic acid (*oxalidacetic acid*), ethyl ester, action of hydrocyanic acid on (THOMAS-MAMERT and WEIL), A., i, 427.

- Cetipic acid** (*oxalodiacetic acid*), ethyl ester, condensation of, with ethylene-diamine and naphthylene-*o*-diamines (THOMAS-MAMERT and WEIL), A., i, 459.
- Cetyleytisine** (RAUWERDA), A., i, 608, 684.
- Chabasite** from North Carolina (PRATT), A., ii, 24.
from Sardinia, and from the granulites of Striegau (RIMATORI), A., ii, 735.
- Chalcocamprite** from Greenland (FLINK), A., ii, 412.
- Champagne**, analyses of modern "dry" (ROSENHEIM and SCHIDROWITZ), A., ii, 372.
- Change**, permanent, and thermodynamics (DUHEM), A., ii, 524, 708.
- Cheese**. See Agricultural Chemistry.
- Cheiranthin** and **Cheirinine** from wall-flower (REEB), A., i, 186.
- Chelerythrine** (MERRILL and SCHLOTTERBECK), A., i, 686.
- Chemical action**. See Affinity.
constitution and composition in relation to density (KANONNIKOFF), A., ii, 184.
and fluorescence (HEWITT and PERKINS), T., 1324; P., 1900, 178; (HEWITT), P., 1900, 3; A., ii, 518.
and physiological action, relation between (PADERI), A., ii, 742.
kinetics (RAMBERG), A., ii, 717.
gaseous reactions in (BODENSTEIN), A., ii, 12.
and free energy of the reaction $2\text{HI} + 2\text{Ag} \rightleftharpoons 2\text{AgI} + \text{H}_2$ (DANNEKE), A., ii, 467.
- Chemistry**, progress of, in Great Britain and Ireland during the 19th century (THORPE), T., 562.
- Chicory**, constituents of (WOLFF), A., ii, 37.
- Chitosamine**. See Glucosamine.
- Chloral**, boiling points of mixtures of water and (CHRISTENSEN), A., i, 626.
action of, on the chloroacetic acids (GABUTTI), A., i, 370.
compound of, with benzylquinaldine (KORNIGS), A., i, 189.
- Chloral alcoholate**, estimation of (SCHMIDINGER), A., ii, 327.
- Chloral hydrate**, physico-chemical properties of (MAUCH), A., ii, 454.
melting point of (WOLF), A., i, 274.
action of, on hemoglobin (FORMÁNEK), A., i, 532.
use of, in estimating alkaloids (SCHAER), A., ii, 57.
estimation of, in organs (RUSSWURM), A., ii, 121.
- Chloral hydrate**, estimation of chloroform and, in toxicological analysis (KIPPENBERGER), A., ii, 581.
- Chlorella vulgaris**, culture of (RADAIS), A., ii, 362.
- Chlorotone**. See Acetonechloroform.
- Chlorine**, evolution of, from chlorates (SODEAU), T., 137, 717; P., 1899, 157; 1900, 88.
amount of, in rain-water collected at Cirencester (KINCH), T., 1271; P., 1900, 183.
spectrum of (EDER and VALENTA), A., ii, 72.
ions, the discharge potential of (MÜLLER), A., ii, 643.
liquid, some properties of (LANGE), A., ii, 649.
colour of solutions of (SARLES), A., ii, 72.
action of, on metallic silver in the light and in the dark (v. CORDIER), A., ii, 343, 723.
nascent, action of, on sulphonic groups in naphthalene derivatives (VAUDEL), A., i, 544.
- Hydrochloric acid** (*hydrogen chloride*), effect of concentration on the magnetic rotation of solutions of (FORCHHEIMER), A., ii, 524.
and sulphuric acid, conductivity of aqueous solutions of (BARNES), A., ii, 522.
dissociation and dissociation equilibrium of (JAHN), A., ii, 522.
dissociation constant of, dissolved in mixtures of organic solvents and water (MORELLO), A., ii, 395.
reversible reaction between silver and (JOUNIAUX), A., ii, 139.
absorption of, from aqueous solution, by colloidal stannic oxide (VAN BEMMELEN and KLOBBIE), A., ii, 338; (VAN BEMMELEN), A., ii, 466.
formation of, in the stomach (WESNER), A., ii, 92.
estimation of, in the presence of chlorates and perchlorates (BLATTNER and BRASSEUR), A., ii, 755.
combined, estimation of (COHNHEIM and KRIEGER), A., ii, 778.
estimation of, in gastric juice (COHNHEIM and KRIEGER), A., ii, 508.
- Chloride of lime**. See Bleaching powder.
- Chlorates**, electrolytic formation of (FOERSTER), A., ii, 72, 400; (MÜLLER), A., ii, 73; (BROCHET), A., ii, 205, 276, 541, 700; (FOERSTER and JORRE), A., ii, 343; (WOLF), A., ii, 382; (SIE-

Chlorine:—

VERTS), A., ii, 470; (WOHLWILL), A., ii, 400, 471; (LORENZ and WEHRLIN), A., ii, 476; (FOERSTER and SONNEBORN), A., ii, 645.

Chlorates, decomposition of (SODEAU), T., 137, 717; P., 1899, 157; 1900, 88.

estimation of, in the presence of chlorides and perchlorates (BLATTNER and BRASSEUR), A., ii, 755.

mixtures of hypochlorites and, iodometric estimation of (DITZ and KNÖPFELMACHER), A., ii, 241.

Hypochlorous acid, action of, on unsaturated acids (MELIKOFF), A., i, 536.

action of, on primary aromatic amines (MEIGEN and NORMANN), A., i, 702.

action of, on tertiary amines (WILLSTÄTTER and IGLAUER), A., i, 458.

action of, on anilides (CHATTAWAY and ORTON), T., 134, 789, 797; P., 1899, 232; P., 1900, 102, 112; (CHATTAWAY, ORTON, and HURTLEY), T., 800; P., 1900, 125; (ARMSTRONG), T., 1047; P., 1900, 160.

action of, on diacetyl- and dibenzoyl-*m*-phenylenediamine (MORGAN), T., 1208; P., 1900, 170.

Hypochlorites, electrolytic formation of (FOERSTER), A., ii, 72, 400; (MÜLLER), A., ii, 78; (BROCHET), A., ii, 205, 276, 541; (FOERSTER and JORRE), A., ii, 343; (WOHLWILL), A., ii, 400, 471; (SIEVERTS), A., ii, 470; (LORENZ and WEHRLIN), A., ii, 476; (FOERSTER and SONNEBORN), A., ii, 645.

electrolysis of solutions of (BROCHET), A., ii, 594, 706.

Perchloric acid, preparation of (MICHAEL and CONN), A., ii, 471.

anhydrous, preparation and properties of (VORLÄNDER and v. SCHILLING), A., ii, 340.

estimation of, in the presence of chlorates and chlorides (BLATTNER and BRASSEUR), A., ii, 755.

Perchlorate in sodium nitrate, injurious effect of, on the growth of sugar beet (STOKLASA), A., ii, 305.

Chlorine monoxide, action of, on benzene (SCHOLL and NÜRR), A., i, 337.

heptoxide (MICHAEL and CONN), A., ii, 471.

Chlorine, estimation and separation of:—

estimation of, in bleaching powder (WOŁOWSKI), A., ii, 165.

Chlorine, estimation and separation of:—

estimation of, in presence of bromine and iodine (v. WESZELSZKY), A., ii, 436.

estimation of, in gastric juice (MEILLERE), A., ii, 509.

separation of, from bromine and iodine (CROTOGINO), A., ii, 642.

separation of, from iodine (VANINO and HAUSER), A., ii, 165.

Chloroform, boiling point of, with mixtures of benzene (HAYWOOD), A., ii, 64.

action of, on alkaloid salts (HILL; SCHAEER), A., ii, 455.

action of, on dimethylpyrrolines (BOCCHI), A., i, 357.

action of, on hæmoglobin (FORMÁNEK), A., i, 532.

non-elimination of, after inhalation (VITALI), A., ii, 31.

estimation of chloral hydrate and, in toxicological analysis (KIPPENBERGER), A., ii, 581.

Chloroglobin, the colouring matter of leaves (TSVETI), A., i, 50.

Chlorophyll. See Agricultural Chemistry.

Cholesterol, reduction of, to coprosterol in the intestine (MÜLLER), A., ii, 289.

detection of, in fats (KREIS and RUDIN), A., ii, 252.

Choline in the suprarenal gland (HUNT), A., ii, 295.

absence of, in cerebro-spinal fluid (v. GULEWITSCH), A., ii, 420.

Chrome alum, nature of the change from violet to green in solutions of (WHITNEY), A., ii, 211; (VENABLE), A., ii, 349.

Chrome steel, analysis of (M'KENNA), A., ii, 765.

estimation of phosphorus in (IBBOTSON and BREARLEY), A., ii, 757.

Chromite (*chrome iron ore*) from Newfoundland (MAYNARD), A., ii, 86.

simple method of decomposing (FIEBER), A., ii, 512.

analysis of, by the borax method (MACIVOR), A., ii, 765.

estimation of silica in (TATE), A., ii, 313.

Chromium in plants (DEMARÇAY), A., ii, 235.

electro-deposition of (COWPER-COLES), A., ii, 408.

electromotive behaviour of (HITTORF), A., ii, 127; (MORGAN and DUFF), A., ii, 539.

behaviour of, towards acids (OSTWALD), A., ii, 730.

- Chromium salts**, hydrolysis of (RICHTARDS), A., ii, 472.
 action of sodium thiosulphate on (FAKTOR), A., ii, 691.
- Chromium azoimide**, basic (CURTIUS and DARAPSKY), A., ii, 474.
 phosphide, preparation of (MARONNEAU), A., ii, 281.
 potassium and sodium sulphates (PAGEL), A., ii, 349.
- Chromous salts**, oxidation of, by atmospheric oxygen (MANCHOT and HERZOG), A., ii, 546.
 oxide, double carbonates of (BAGGÉ), A., ii, 349.
 ammonium sulphate (LAURENT), A., ii, 547.
- Chromic acid**, recovery of, from chromium residues (REGELSBERGER), A., ii, 79.
 estimation of, volumetrically, by arsenious acid (REICHARD), A., ii, 691.
 estimation of, in solutions for purifying acetylene (ULLMANN and GOLDBERG), A., i, 1.
- Chromates**, alkali, detection of, in milk (LEYS), A., ii, 110.
- Chromium organic compounds** :—
- Chromium salts**, compounds of, with pyridine, triethylenediamine and tripropylenediamine (PFEIFFER), A., i, 559.
- Chlorochromic acid**, pyridine and quinoline salts of (MEYER and BEST), A., ii, 79.
- hexa*-**Chlorotrichromyl chloride**, pyridine salt of (MEYER and BEST), A., ii, 79.
- Chromium**, estimation and separation of :—
 estimation of, in iron and steel (DÖHLER; MAHON), A., ii, 110.
 separation of, from iron (HAVENS and WAY), A., ii, 50.
- "Chromone"** (*pheno- γ -pyrone*) (BLOCH and V. KOSTANECKI), A., i, 308.
- Chromyl dichloride**, molecular weight of, in various solvents (ODDO and SERRA), A., ii, 75.
 action of nitric oxide on (THOMAS), A., ii, 144.
- Chrysanthemum japonicum*, oil of (PERRIER), A., i, 352.
- Chrysarobin** and its acetyl derivatives (HESSE), A., i, 41.
 oxidation products of (MARFORI), A., i, 553.
- Chrysean**, its acetyl derivative and its condensation with aldehydes (HELLSING), A., i, 518.
- Chrysenic acid** (GRAEBE and HÖNIGSBERGER), A., i, 506.
- Chrysenic acids**, constitution of (GRAEBE), A., i, 296.
- Chrysoidine** hydrochloride, bromo- and chloro- (MORGAN), T., 1205; P., 1900, 170.
- Chrysoidinesulphonic acid**, chloro- and bromo-, potassium salts of (MORGAN), T., 1205.
- Chrysoketone** and its carboxylic acid (GRAEBE and HÖNIGSBERGER), A., i, 505.
- Chrysophanic acid** (*dihydroxymethyl-anthraquinone*) and its acetyl derivatives (HESSE), A., i, 40; (LIEBERMANN), A., i, 355.
 isomeric forms of (MARFORI), A., i, 553.
- Chrysophanohydroanthrone** and its diacetyl derivative (HESSE), A., i, 42.
- Chrysoquinone** and its oxidation products, and its oxime and acids (GRAEBE and HÖNIGSBERGER), A., i, 505.
- Chrysotile**, composition of (VAN DER BELLEN), A., ii, 603.
- Chymosin** and **Parachymosin** (BANG), A., ii, 356.
- Chyle**, human (PANZER), A., ii, 672.
 composition of the fat of (ERBEN), A., ii, 739.
- Cider** and **Cider vinegar**, analysis of solids and ash of (DOOLITTLE and HESS), A., ii, 450.
- Cigars**, estimation of nicotine in (THOMAS), A., ii, 428.
- apo***Cinchonine**, its constitution and its nitro- and amino-derivatives and their ethers (KOENIGS), A., i, 245.
- Cinchomeronic acid**, esterification of (KIRPAL), A., i, 51.
- Cinchona alkaloids**, conversion of, into 4-phenylquinoline derivatives (KOENIGS), A., i, 245.
- α - and β -*iso*- ψ -**Cinchonicine** and their compounds (SKRAUP), A., i, 605; (SKRAUP and ZWERRER), A., i, 606.
- Cinchonine** and its compounds (SKRAUP and ZWERRER), A., i, 606.
 molecular transformation of (WEGSCHEIDER), A., ii, 532.
- α - and β -*iso***Cinchonine** and their compounds (SKRAUP and ZWERRER), A., i, 606.
- β -*iso***Cinchonine**, constitution of, and its compounds (SKRAUP), A., i, 605.
- allo***Cinchonine sulphate** (SKRAUP and ZWERRER), A., i, 606.
- Cinder**, blast-furnace, estimation of alumina as phosphate in (CAMP), A., ii, 763.

- Cinenic acid** and its esters and **Cineolic acid** (RUPE), A., i, 371.
- Cinnamal.** See **Cinnamylidene**.
- Cinnamaldehydephenylhydrasone**, oxidation of (MINUNNI and ORTOLEVA), A., i, 260.
- Cinnamene**. See **Styrene**.
- Cinnamhydroxamic acid** and its acetyl and benzoyl derivatives (THIELE and PICKARD), A., i, 29.
- Cinnamic acid** (*β -phenylacrylic acid*), sublimation point of (LIEBERMANN and RIIBER), A., i, 648.
- ethyl ester, action of aniline and hydroxylamine on (TINGLE), A., i, 544.
- condensation of, with phenylacetonitrile (ERLENMEYER), A., i, 493.
- Cinnamic acid**, *m*- and *p*-amino-, glycinyl derivatives of the esters of (EINHORN and OPPENHEIMER), A., i, 494.
- alloeinnamic acid**, boiling point of (LIEBERMANN and RIIBER), A., i, 648.
- Cinnamonitriles**, *o*-nitro- and *o*-amino-, isomeric change of (PSCHORR and WOLFES), A., i, 170.
- Cinnamylguaiacol** (COHN), A., i, 548.
- Cinnamylidenecetic acid**, and the *alloe*-acid, sublimation points of (LIEBERMANN and RIIBER), A., i, 648.
- Cinnamylidene-2-naphthylamine**, 1-bromo- and 1-chloro-, and their hydrocyanides (MORGAN), T., 1217; P., 1900, 171.
- Cinnamylidenesemicarbazone**, oxidation of (YOUNG and WITHAM), T., 230; P., 1900, 5.
- Circulation**, influence of iodine, sodium iodide, and iodothyron on the (BARBERA), A., ii, 291.
- influence of removal of water on the (STRAUB), A., ii, 91.
- Citral**, from oil of verbena (KERSCHBAUM), A., i, 353.
- stereoisomerism of (TIEMANN and KERSCHBAUM), A., i, 331; (BARBIER), A., i, 508.
- colour reaction for (BURGESS), A., ii, 774.
- b-Citralideneacyanoacetic acid** (TIEMANN), A., i, 331.
- Citraprotartaric acid**. See **Methylsuccinic acid**.
- Citrazinic acid**, constitution of (SELL and DOOTSON), T., 233; P., 1900, 9.
- Citric acid** in saturation-sludge (ANDRLIK), A., ii, 679.
- oxidation of, by potassium permanganate (DENIGES), A., i, 89, 204, 274; (SABBATANI), A., i, 536.
- physiological action of (SABBATANI), A., ii, 32.
- Citric acid**, salts of, oxidation of, by potassium permanganate or by iron (SABBATANI), A., i, 536.
- alkali copper salts of (BULLNHEIMER and SEITZ), A., i, 330.
- detection of (DENIGES), A., i, 89.
- detection of salicylic acid in presence of (LANGKOPF), A., ii, 695, 769; (CONRADY; GEROCK), A., ii, 769; (KLETT), A., ii, 770.
- Citronella oil** (SCHIMMEL and Co.), A., i, 184.
- estimation of geraniol in (SCHIMMEL and Co.), A., ii, 175.
- Citronellal**, isomeric change of (LABBÉ), A., i, 136.
- Citronellaldimethylacetal** (HARRIES), A., i, 331.
- Citronellol** (BOUVEAULT), A., i, 452.
- Citronellyl and Citryl barium sulphites**, formation of (LABBÉ), A., i, 137.
- Civet**, constituents of (WALBAUM), A., i, 509.
- Clay**, fireproof, from Moravia (KUVÁK), A., ii, 147.
- rapid estimation of, in soils (POQUILLON), A., ii, 316.
- separation of, from sand in soils (SCARLATA), A., ii, 368.
- Clays**, examination of (GLINKA), A., ii, 89.
- estimation of sand in (CRONQUIST), A., ii, 171.
- Clover**. See **Agricultural Chemistry**.
- Coal** from Bohemia (EICHLEITER), A., ii, 354.
- from New Zealand, composition of (BEDSON), A., ii, 20.
- spontaneous combustion of (GRIMM), A., ii, 205.
- apparatus for determining the calorific value of (MAGNANINI and ZUNINO), A., ii, 465.
- analysis (NOYES, HILLEBRAND, and DUDLEY), A., ii, 168.
- estimation of phosphorus in (CAMP), A., ii, 756.
- Coal calorimeter**, new (PARK), A., ii, 710.
- Coal gas**, naphthalene vapour in (ALLEN), A., i, 339.
- estimation of benzene and ethylene in (HABER), A., ii, 629.
- estimation of naphthalene in (COLMAN and SMITH), A., ii, 372.
- Cobalt**, atomic weight of (RICHARDS and BAXTER), A., ii, 78.
- specific heat of (TILDEN), A., ii, 524.
- passivity of (HITTORF), A., ii, 706.
- occlusion of hydrogen by (BAXTER), A., ii, 78.

- Cobalt salts**, oxidation of, in alkaline solution (JOB), A., ii, 657.
- Cobalt borates** (OUVRARD), A., ii, 207.
- chloride, thermal capacity and colour changes of solutions of (WREWSKY), A., ii, 63.
- fluoride, double salts of, with aluminium or ferric fluoride (WEINLAND and KÖPPEN), A., ii, 143.
- nitrite, double potassium and sodium salt of (ADIE and WOOD), T., 1076; P., 1900, 17.
- sodium nitrite, preparation of (BILLMANN), A., ii, 624.
- oxides, formation of (MAWROW), A., ii, 596.
- hydrated, green- and buff-coloured (HARTLEY), P., 1899, 202.
- phosphide, preparation of (MARONNEAU), A., ii, 281.
- potassium sulphate (MALLET), T., 222; P., 1899, 227.
- Cobalt organic compounds** :—
- Cobaltammonium compounds**, thiocyanate (WERNER, MÜLLER, KLIEN, and BRÄUNLICH), A., i, 86; (V. ZAWIDZKI), A., i, 210.
- thiocyanate and its double salts (MIOLATI), A., i, 381.
- Oxycobaltamine thiocyanates** (MASCETTI), A., i, 541.
- Cobaltcyanides**, their preparation and use in analysis (MILLER and MATHEWS), A., ii, 318; (MATHEWS), A., ii, 578.
- Cobaltocyanide**, potassium, oxidation of, by atmospheric oxygen (MANCHOT and HERZOG), A., ii, 546.
- Cobalt, estimation and separation of** :—
- estimation of, in New Caledonian ores (MOORE), A., ii, 764.
- estimation and separation of small quantities of, in presence of nickel (MOORE), A., ii, 764.
- separation of, from nickel, by the action of ammonium hydroxide on the ferricyanides (BROWNING and HARTWELL), A., ii, 765.
- separation of, from nickel, by means of persulphates (MAWROW), A., ii, 596, 765.
- separation of, from nickel, by means of their sulphides (TOWER), A., ii, 690.
- Cobalt ores**, auriferous, from the Transvaal (OEHMICHEN), A., ii, 147.
- Cobra toxin and antitoxin** (MYERS), A., ii, 558.
- Cocaine**, chromic acid test for (SCHAEFER), A., ii, 58.
- Cochinelle acid**, mixed esters and diketohydrindene derivatives of (LANDAU), A., i, 661.
- Cocoanut ash**, composition of (BACHOFEN), A., ii, 302; (BAIN and BACHOFEN), A., ii, 497.
- Codeine**, colour test for (KOBERT), A., ii, 121.
- Cerulein and Cerulin** and their acetyl derivatives (ORNDORFF and BREWER), A., i, 448.
- Coffee extracts**, their composition and analysis (MOOR and PRIEST), A., ii, 379.
- Coke**, estimation of volatile combustible matter in (MEADE and ATTIX), A., ii, 168.
- estimation of phosphorus in (CAMP), A., ii, 756.
- Colloid**, ovarian (PANZER), A., i, 70.
- Colloidal solutions**, nature and properties of (BREDIG and COEHN), A., ii, 269; (BRUNI and PAPPADÀ), A., ii, 591.
- dissociation in (LEVI), A., ii, 646.
- metallic (STOECKL and VANINO), A., ii, 11, 713; (ZSIGMONDY), A., ii, 397.
- preparation of, by the electric discharge (BREDIG), A., ii, 213.
- Colloids**, absorption and emission of water vapour by (DUHEM), A., ii, 338.
- absorption of matters from solution by (VAN BEMMELLEN), A., ii, 466.
- Colophony oil**, composition of (KRAEMER and SPILKER), A., i, 150.
- Coloradoite** (?) from California (HILLEBRAND), A., ii, 22.
- Colour of alkali nitrites** (DIVERS), P., 1900, 40.
- of bromine and iodine compounds, effect of very low temperatures on (KASTLE), A., ii, 526.
- of chlorine solutions (SABLES), A., ii, 72.
- of solutions of chrome alum, change in (WHITNEY), A., ii, 211; (VENABLE), A., ii, 349.
- of solutions of cobalt chloride, change of (WREWSKY), A., ii, 63.
- of Congo-red, cause of the change of, by the action of acids (SCHIMANSKY), A., i, 305.
- of minerals (NABL), A., ii, 661.
- of picric acid and its solutions (MARCKWALD), A., i, 391.
- of aqueous salt solutions, causes of the changes of (KONOWALOFF), A., ii, 266.
- of sodium nitrite solutions (BOGUSKI), A., ii, 75.
- changes. See also Phototrophy.
- Colour-bases**, transformation of, into pseudo-ammonium hydroxides, -cyanides, and -sulphonic acids (HANTZSCH and OSSWALD), A., i, 256.

Coloured substances, derived from nitro-compounds (HANTZSCH and KISSEL), A., i, 89; (JACKSON and GAZZOLO), A., i, 438.

Colouring matters from p-aminophenol, hydroxyazobenzene and sulphur (RIS), A., i, 419.

of annatto (ZWICK), A., i, 518.

of *Arctostaphylos Uva-ursi*, *Coriaria myrtifolia*, *Hæmatoxylon campechianum*, *Myrica Gale*, *Rhus Melopium*, and *Robinia Pseudacacia* (PEEKIN), T., 423; P., 1900, 45.

in blood, simultaneous estimation of two (HÜFNER), A., ii, 459.

of chlorophyll and their spectra (MARCHLEWSKI and SCHUNCK), T., 1080; P., 1900, 148.

coal-tar, detection of, in food and fruit products (WINTON), A., ii, 776.

from *Digitalis lutea* (ADRIAN and TRILLAT), A., i, 185.

$C_{18}H_{12}ON_2$ of *Echinus esculentus* (GRIFFITHS), A., ii, 677.

of the formazyl group (FICHTER and SCHIESS), A., i, 366.

of leaves (SCHUNCK), A., ii, 36.

$C_{22}H_{16}O_4$ from the oxidation of methoxynaphthol (RUSSIG), A., i, 602.

of saffron (HILGER), A., i, 682.

in "sugar-colours," and their detection (SCHWEITZER), A., i, 277.

resembling indulines, electrolytic preparation of (LÖB), A., i, 464.

oxazine, constitution of (KEHRMANN), A., i, 61; (GREEN), A., i, 119.

oxazine, safranine, and thiazine, o-quinonoid structure of (GREEN), A., i, 119.

new blue, of the thiazine series (SCHAPOSCHNIKOFF), A., i, 523.

influence of the orientation of chromophores on the colour and other properties of (REVERDIN and CRÉPIEU), A., i, 701.

methylation of (PRUD'HOMME), A., i, 244, 455.

combination of basic with acidic (SEYEWETZ), A., i, 356.

acidic, composition of, with compounds of magenta (SEYEWETZ), A., i, 522.

having a basic chromophore, compounds of, with magenta (SEYEWETZ), A., i, 645.

sulpho-azo-, compounds of, with magenta (SEYEWETZ), A., i, 614.

new, of acid function (PRUD'HOMME), A., i, 455.

new blue, fast to alkalis (PRUD'HOMME), A., i, 455.

Colouring matters, basic and tanning, Ullmann's tests for (HEINEMANN), A., ii, 380.

precipitation of, by ammonium persulphate (PRÖSCHER), A., i, 454.

Colouring matters. See also:—

Acacetin.

Alkaramel.

Apigenin.

Apigetrin.

Apin.

Bilirubin.

Brazilein.

Brazilin.

Chloroglobin.

Chlorophyll.

Genistein.

Hæmatin.

Hæmatoporphyrin.

Hæmatoxylin.

Hæmin.

Hæmochromogen.

Hæmoglobin.

Indigo.

Luteolin.

Myricetin.

Phylloporphyrin.

Phylloxanthin.

Pyocyanin.

Quercetin.

Tetramethylhæmatoxylin.

Trimethylbrazilin.

Urobilin.

Vitexin.

Columbinin, action of dilute acids, alcohol, and heat on (PANORMOFF), A., i, 709.

Columbite group, a mineral of the (GOODWIN and MILLER), A., ii, 662.

Combustion, apparatus for demonstrating the reciprocal nature of (TEGLU), A., ii, 71.

Comenic acid, constitution of (PERATONER and LEONARDI), A., i, 550. diethyl ester (OLIVERI-TORTORICI), A., i, 587.

Compositæ, distribution of alkaloids in (GRESHOFF), A., i, 556.

Conchiolin, decomposition products of (WETZEL), A., i, 71.

Condensation waves, propagation of, in heated gases (LE CHATELIER), A., ii, 645.

Conductivity, electrical. See Electrochemistry.

heat. See Thermochemistry.

Congo-red, cause of the change of colour of, by the action of acids (SCHIMANSKY), A., i, 305.

Conifer-seeds, decomposition products of proteids of (SCHULZE and WINTERSTEIN), A., ii, 101.

Coniine, detection of, in poisoning cases (VITALI and STROPPIA), A., ii, 639.

Consolicine and Consolidin (GRIMMER), A., i, 684.

Copper in plants (MACDOUGAL), A., ii, 235.

electrochemical equivalent of (RICHARDS, COLLINS, and HEIMROD), A., ii, 256.

heat of combination of, with zinc (BAKER), P., 1899, 195; (GALT), A., ii, 189.

solution of, in gelatin solutions (LIDOFF), A., ii, 77.

precipitates in analysis (IMMERWAHR), A., ii, 642.

Copper-ammonium chromate, a new (SCHUYTEN), A., ii, 279.

iodides, reactions of (POZZI-ESCOT), A., ii, 207.

Copper alloys with zinc, negative heat of formation of (BAKER), P., 1899, 195; (GALT), A., ii, 189.

action of, on nitric acid (GLADSTONE), A., ii, 710.

Copper salts, solubility of, in sucrose solutions (STOLLE), A., i, 333.

action of alkali hydroxides and bromine on (VITALI), A., ii, 208.

carbonate (GRÜGER), A., ii, 542.

chloride, combination of, with ammonia in aqueous solution (DAWSON and McCRAE), T., 1245; P., 1900, 172.

fluoride, double salts with aluminium fluoride (WEINLAND and KÖPFEN), A., ii, 144.

haloids, double salts with ammonium thiosulphate (ROSENHEIM and STEINHÄUSER), A., ii, 653.

oxide, combination of, with ammonia in aqueous solution (DAWSON and McCRAE), T., 1255; P., 1900, 173.

oxides, action of acetylene on (GOOCH and BALDWIN), A., i, 74.

sulphate, combination of, with ammonia in aqueous solution (DAWSON and McCRAE), T., 1243; P., 1900, 172.

estimation of the purity of, and of the amount of, in copper pyrites (MONTANARI), A., ii, 315.

estimation of (ZECCHINI), A., ii, 762.

manganese sulphates, solubility of (STORTENBEKKER), A., ii, 530.

polysulphide (BODROUX), A., ii, 480.

sulphites and thiosulphate, double, with the alkali metals (ROSENHEIM and STEINHÄUSER), A., ii, 652.

sulphovanadite. See Sulvanite.

thioantimonites and their double salts with potassium (POUGET), A., ii, 84.

Copper:—

Cupric salts, oxidising action of, in presence of cyanogen compounds (SCHAER), A., i, 512; ii, 583.

chloride, solubility of, in organic liquids (OECHSNER DE CONINCK), A., ii, 542.

oxide, hydrated, formation of (MAWROW), A., ii, 402.

sulphate, reaction of solutions of, with magnesium, iron, or zinc (CAVEN), P., 1899, 232; A., ii, 344.

Cuprous chloride, compounds of, with acetylene and potassium chloride (CHAVASTELON), A., i, 470.

compounds of, with carbon monoxide (JONES), A., ii, 17.

Copper organic compounds:—

Cupric methyl- and benzyl-salicyl-imides (DELEPINE), A., i, 177.

Cuprous acetylde, compounds of, with cuprous iodide (BERTHELOT and DELEPINE), A., i, 324.

Copper, detection, estimation, and separation of:—

detection of (CAZENEUVE), A., i, 465; (VITALI), A., ii, 208.

analysis of (CLARK), A., ii, 369; (HOLLARD), A., ii, 442.

estimation of (WILLENZ), A., ii, 315.

estimation of, volumetrically (PARR), A., ii, 762.

estimation of, in cyanide solutions (CLENNELL), A., ii, 370.

estimation of, in iron (HEKTING), A., ii, 245.

estimation and separation of, by sodium hydroxide and hydrazine sulphate or hydrochloride (JANNASCH and BIEDERMANN), A., ii, 315.

estimation of oxygen in, by ignition in hydrogen (ARCHBUTT), A., ii, 756.

Copper pyrites, estimation of copper sulphate in (MONTANARI), A., ii, 315.

Coprosterol, origin of, in the intestine (MÜLLER), A., ii, 289.

Coral (*Heliopora corallina*), blue pigment of (LIVERSIDGE), A., i, 70.

Corals, iodine in (MENDEL), A., ii, 677.

Cordylite (*barium-parisite*) from Greenland (FLINK), A., ii, 410.

Coriaria myrtifolia, constituents of (PERKIN), T., 428; P., 1900, 45.

Cork oak. See Agricultural Chemistry.

Corn oil. See Maize oil.

Cornutine, estimation of (MUSSET), A., ii, 121.

Corresponding states (MEYER), A., ii, 263; (BERTHELOT), A., ii, 335, 646.

Corrosive sublimate. See Mercuric chloride under Mercury.

- Cortex Lokri*, constituents of (VAN DEN DRIESSEN-MAREEUW), A., ii, 102.
- Corundum** from Eastern Ontario (MILLER), A., ii, 552.
and corundum-bearing rock, composition of (GOODWIN), A., ii, 661.
- Cotarnine** and its derivatives (FREUND and PREUSS), A., i, 248.
formula of (DECKER), A., i, 683.
oxidation products of (WULFF), A., i, 607.
cyanide as a pseudo-salt (HANTZSCH and KALB), A., i, 557.
- ψ-**Cotarnine** and its cyanide (HANTZSCH and KALB), A., i, 115.
- Cotarnimethylimine** (WULFF), A., i, 607.
- Cotoin** (HESSE), A., i, 35.
- Cotton-seed oil**, adulteration of, with maize oil (MORPURGO and GÖTZL), A., ii, 377.
Bechi's test for (VAN ENGLEN; SOLT-SIEN), A., ii, 116.
Halphen's colour reaction for the identification of (RAIKOW), A., ii, 698.
Bechi and Halphen's colour tests for, in oils (RAIKOW and TSCHERWENIWANOW), A., ii, 252.
estimation of, by Halphen's test (STRZYZOWSKI), A., ii, 325; (OILAR), A., ii, 772.
- Coumarilic acid**, bromo- and chloro- (STOERMER), A., i, 654.
dibromo- (SIMONIS and WENZEL), A., i, 231, 496, 648.
- Coumarin**, preparation and constitution and bromine derivatives of (SIMONIS and WENZEL), A., i, 231, 496, 648.
- Coumarins** (v. PECHMANN; v. PECHMANN and SCHALL), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.
- Coumarone** and its polymeride, and chloro-, bromo-, and bromonitro-derivatives (STOERMER), A., i, 650.
bromo-derivatives (SIMONIS and WENZEL), A., i, 232, 497, 648.
- Coumarone resin** (KRAEMER and SPILKEE), A., i, 656.
- Coumaroxycetic acid**, bromo- (STOERMER), A., i, 654.
- Cows**. See Agricultural Chemistry.
- Crackene** from mineral oil (KLAUDY and FINK), A., i, 284.
- Cream**, analysis of (RICHMOND), A., ii, 696.
See also Agricultural Chemistry.
- Creatine** and **Creatinine**, physiological action of (MALLER), A., ii, 156.
- "**Cremomites**," new explosives (ALVISI), A., ii, 205.
- Cresote**, assay of (HALL), A., ii, 580.
wood-tar, estimation of guaiacol in (KEBLER), A., ii, 176.
- o-Cresol**, tetra- and penta-bromo- (AUWERS and ANSELMINO), A., i, 160.
4-nitro- (HILL, SOCH, and OENSLAGER), A., i, 538.
- m-Cresol**, specific heat and heat of vaporisation of (LUGININ), A., ii, 334.
estimation of, in mixtures of cresols (RASCHIG), A., ii, 694.
- m-Cresol**, tetrabromo- (AUWERS and ANSELMINO), A., i, 160.
and its acetyl and benzoyl derivatives (AUWERS and BULLOWS), A., i, 99.
ω:2:4:5:6-pentabromo- (AUWERS and ANSELMINO), A., i, 160; (AUWERS and BROICHER), A., i, 162.
5:2-bromonitro- (THIELE and EICHWEDE), A., i, 501.
- p-Cresol**, tribromo-, product of the action of nitric acid on, and its acetyl derivative (ZINCKE), A., i, 545.
5:3-bromoamino- and 5:3-bromonitro- (THIELE and EICHWEDE), A., i, 501.
- Cresols**, o-, m-, and p-, condensation of, with ethyl phenylpropiolate (RUHEMANN and BEDDOW), T., 984, 1119; P., 1900, 123, 165.
analysis of mixtures of phenol and (DITZ and CEDIVODA), A., ii, 54; (VAUBEL), A., ii, 112.
estimation of (CLAUSEE), A., ii, 319.
- Cresols**, o-, m-, and p-, bromo- and chloro-derivatives, action of nitrous and nitric acids on (ZINCKE), A., i, 545.
- Cresoxy-**. See Tolyoxy-.
- Cresses**. See *Barbarea praecox*, *Lepidium sativum*, and *Nasturtium officinale*.
- Critical constants** of diisopropyl and diisobutyl (YOUNG and FORTY), T., 1126; P., 1900, 165.
of n-octane (YOUNG), T., 1145; P., 1900, 166.
density and the law of Cailletet and Mathias (YOUNG), A., ii, 711.
point of pure liquids and mixtures, disturbing influences at the (v. HIRSCH), A., ii, 388.
state (DINTERICI), A., ii, 67.
temperature of complete mixture, influence of pressure on (VAN DER LEE), A., ii, 129.
of organic sulphur compounds (FERRETTO), A., ii, 386.
- Cretonic acid**, mercuri-compound of (LEY), A., i, 382.
ethyl ester, condensation of, with ethyl oxalate (LAPWORTH), P., 1900, 132.

- Grotonic acid**, β -amino-, ethyl ester, action of phenylcarbinide on (BEHREND and MEYER), A., i, 287.
- α - and β -bromo- (MELIKOFF), A., i, 536.
- β -bromoamino- and β -chloroamino-, ethyl ester (BEHREND and SCHREIBER), A., i, 210.
- γ -chloro-, and its nitrile and ethyl ester (LESPIAU), A., i, 425.
- α -cyano-, ethyl ester, β -amino-, and β -alkyloxy derivatives of (HALLER), A., i, 373.
- Cryoscopic behaviour** of nitro-derivatives in formic acid (BRUNI and BERTI), A., ii, 591.
- of substances with constitutions similar to that of the solvent (GARELLI and CALZOLARI), A., ii, 65.
- observations, apparatus for (BATELLI and STEFANINI), A., ii, 709.
- observations in various solvents (AUWERS), A., ii, 262.
- Cryoscopy**, antimony trichloride as a solvent in (TOLLOZKO), A., ii, 190.
- of phenols, influence of the solvent on (AUWERS, BARTSCH, and SMITH), A., ii, 66.
- of Tanret's rhamnino- and rhamnino-trionic acid (PONSOT), A., i, 333.
- See also Freezing point.
- Crystalline-liquids** (SCHENCK), A., ii, 339.
- Crystallography** and atomic weights (MUTHMANN), A., ii, 533; (LINCK), A., ii, 717.
- of *d*- and *l*-isomarine (POPE), T., 787; P., 1900, 118.
- Crystals**, apparatus for dissolving (HOPKINS), A., ii, 71.
- mixed (ROOZEBOOM), A., ii, 64, 70, 132; (VAN EIJK), A., ii, 133; (ADRIANI), A., ii, 462.
- formation and transition of (HISINK), A., ii, 339.
- conversion of, into a compound (ROOZEBOOM), A., ii, 70.
- of mercuric bromide and iodide (REINDERS), A., ii, 70.
- of potassium and thallium nitrates, formation and transition of (VAN EIJK), A., ii, 133.
- Crystal-violet and Crystal-violet leuco-hydroxide salts** (HANTZSCH), A., i, 365.
- ψ -Cumene (1:3:4-triethylbenzene), refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.
- ψ -Cumene-diazocyanide, and -diazonium cyanide (HANTZSCH), A., i, 568.
- ψ -Cumenediazohaloids (HANTZSCH), A., i, 568.
- ψ -Cumenesyndiazotate, potassium (HANTZSCH), A., i, 567.
- ψ -Cumenol, sodium derivative, compounds of, with the ethyl esters of α -bromo-fatty acids (BISCHOFF), A., i, 394.
- tribromo-, isomeric, constitution, and oxidation products of (AUWERS; AUWERS and EBNER), A., i, 161.
- ψ -Cumenoxypropionacetal (STOERMER), A., i, 653.
- $\alpha\psi$ -Cumenoxypropionic acid and its ethyl ester (BISCHOFF), A., i, 394.
- Cuminuric acid, ethyl ester (RÜGHEIMER and FEHLHABER), A., i, 610.
- Cuminuroflavin (*di-p-isopropylhippuroflavin*) and its anilides (RÜGHEIMER and FEHLHABER), A., i, 610.
- Cuminylidenebisdimethyldihydroresorcinol (VORLÄNDER and STRAUSS), A., i, 100.
- Cuminylidene-2-naphthylamine, 1-bromo- and 1-chloro-, and their hydrocyanides (MORGAN), T., 1216; P., 1900, 171.
- Cuprene, formation of (SABATIER and SENDERENS), A., i, 197, 421.
- Cupric and Cuprous. See under Copper.
- Curangin and Curangaegenin (BOERSMA), A., i, 243, 304.
- Currents. See Electrochemistry.
- Cyanamides, formation of, from the action of cyanogen bromides on tertiary amines (v. BRAUN), A., i, 430, 641.
- combination of, with ethyl or methyl alcohol (STIEGLITZ and MCKEE), A., i, 340.
- Cyanogen, action of, on aromatic amines (MEVES), A., i, 483.
- bromide, action of, on tertiary amines (v. BRAUN), A., i, 430, 641, 687.
- and aluminium chloride, action of, on benzenoid hydrocarbons (SCHOLL and NÖRR), A., i, 386.
- action of, on diethyl- and dimethyl-aniline (SCHOLL and NÖRR), A., i, 435.
- action of, on ethyl acetonedicarboxylate (DERÔME), A., i, 426.
- triselenide (MUTHMANN and SCHREÜDER), A., i, 479.
- Hydrocyanic acid (Hydrogen cyanide)** in Vicia seeds (BRUYNING and VAN HAARST), A., ii, 160.
- preparation of (BROWNING), T., 1235; P., 1900, 172.
- constitution of (WADE), P., 1900, 156.
- dissociation constant of (WALKER and CORMACK), T., 15; P., 1899, 208.

Cyanogen :—

Cyanides, double, electrical conductivity of (WALDEN), A., i, 430.

isoCyanic acid, relation of, to fulminic acid (SCHOLL and KACER), A., i, 218.

isoCyanides, compounds of, with aldehydes and alkyl iodides (WADE), P., 1900, 157.

"Cyanide musk." See Butylxyl cyanide, *dinitro*.

Cyanomethæmoglobin. See under Hæmoglobin.

p-Cyantoline (PIEPES-PORATYŃSKI), A., i, 648.

Cyan-o- and -m-xylins (SCHOLL and NÖBB), A., i, 386.

Cyaphenin from benzenylmethylimino-chloride (v. PECHMANN and OBERMILLER), A., i, 294.

Cyclic compounds (KURSAOFF), A., i, 89.

behaviour of, at low temperatures (MARKOWNIKOFF), A., i, 18.

oxidation of (MARKOWNIKOFF), A., i, 475.

Cycloptertine, a new protamine (MORROWIN), A., i, 72.

Cymene from fir-wood (*Pinus Abies*) (KLASON), A., i, 676.

2-chloro- and 2-bromo- from carvone (KLAGES and KRAITH), A., i, 48.

Cymene (1:4-methylisopropylbenzene) refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.

Cynoglossine (GREIMER), A., i, 683.

Cystin from keratin (MÜRNER), A., i, 128.

detection and estimation of, in well waters (CAUSSE), A., ii, 457, 458.

Cystinuria, excretion of diamines in (CAMMIDGE and GARROD), A., ii, 229.

Cytisine and its alkyl derivatives (RAUWERDA), A., i, 607, 684.

and its physiological action (SCHMIDT; LITTSCHNEID), A., i, 513.

action of phenylthiocarbimide on (LITTSCHNEID), A., i, 513, 516.

Cytotoxins (BORDET; CANTACUZÈNE; BESREDKA; METCHNIKOFF; METCHNIKOFF and BESREDKA), A., ii, 741.

D.

Dacite from Sumatra (MILCH), A., ii, 150.

Damascenine and its salts (POMMERHNE), A., i, 684.

from nigella oil (SCHIMMEL and Co.), A., i, 184.

Dammar, examination of (DIETERICH), A., ii, 118.

Datolite from Dartmoor (BUSZ), A., ii, 217.

Datura Stramonium, estimation of the alkaloids of the leaves of (SCHMIDT), A., ii, 379.

Decahydroacridinedione, base, $C_{13}H_{13}O_2N$ from (VORLÄNDER and KALKOW), A., i, 99.

Decane-*ax*-dicarboxylic acid (KOMPPA), A., i, 201.

Decarboxy*di*bromocarmine acid and its acetyl and benzoyl derivatives (LIEBERMANN, HÖRING, and WIEDERMANN), A., i, 236.

Decarbusic acids, *n*- and *iso*- (WIDMAN), A., i, 347.

Decenoic acids (WALLACH), A., i, 590.

Decolic acids, amino- (WALLACH), A., i, 590.

Decomposition. See under Affinity.

Dehydracetic acid (COLLIE), T., 971; P., 1900, 147.

action of hydroxylamine on, and its oximes (MINUNNI), A., i, 198.

Dehydrocamphoric acid, formation and oxidation of (LAPWORTH), T., 1056; P., 1900, 128.

Dehydropiperonalphenylhydrazone (MINUNNI), A., i, 260.

Denitrification. See Agricultural Chemistry.

Density of chemical compounds in relation to composition and constitution (KANONNIKOFF), A., ii, 134.

conductivity and surface tension of aqueous solutions containing potassiumchloride and sulphate (BARNES), A., ii, 332.

determinations, new pycnometer for (GÜCKEL), A., ii, 193.

of liquids and saturated vapours (v. HIRSCH), A., ii, 9.

of the halogens, nitrogen and oxygen at their boiling points (DRUGMAN and RAMSAY), T., 1228; P., 1900, 172.

of erbium, yttrium, and zirconium (MEYER), A., ii, 143.

of sodium tungstate solutions (PAWLEWSKI), A., ii, 400.

of sulphur perfluoride (MOISSAN and LEBEAU), A., ii, 342.

of tellurium (LENHER and MORGAN), A., ii, 273.

of yttria (MUTHMANN and BÖHM), A., ii, 209.

See also Vapour density.

Deoxybenzoic benzylideneanilines and their hydrochlorides, isomeric (FRANCIS), T., 1191; P., 1900, 169.

- Deoxycaffeine** (5-oxy-1:4:6-trimethyl-6:7-dihydropurine) and its salts (BAILLIE and TAFEL), A., i, 121.
- Deoxymorphine** (SCHRYVER and LEES), T., 1024; P., 1900, 143.
- Deoxytheobromine** (5-oxy-1:4-dimethyl-6:7-dihydropurine) (TAFEL), A., i, 121.
- Derride**, a fish poison, and its anhydride (VAN SILLEVOLDT), A., i, 109.
- Desylacetomesitone** and **Desyl- α - and - β -acetonsaphthones** (SMITH), A., i, 38.
- Dextran**, formation of, by micro-organisms (BORKHOUT), A., ii, 742.
- Dextrins**, preparation of (PRIOR and WIEGMANN), A., i, 541.
formation of, from starch, and action of amylase, on (POTTEVIN), A., i, 80.
nomenclature of (SYNIEWSKI), A., i, 79.
of saccharification (PETIT), A., i, 589.
- Dextrins**. See also Achroodextrin and Maltodextrin.
- Dextrose** (d-glucose, grape sugar) in beet leaves (LINDER), A., ii, 302.
action of potassium persulphate on (MORRELL and CROFTS), T., 1220; P., 1900, 172.
derivatives of (KOENIGS and KNORR), A., i, 588.
phenylosazones of (NEUBERG), A., i, 139.
- Diabase**, weathering of, in Virginia (WATSON), A., ii, 488.
- Diabetes mellitus**, sugar formation in (ROSENQVIST), A., ii, 155.
- Diacetanilide**, 2:6:4-dichloronitro- (CHATTAWAY and ORTON), A., i, 643.
- Diacetone-allyl- and -phenyl-thiocarbamides** and oxime (TRAUBE and LORENZ), A., i, 116.
- Diacetonecamine**, carbamide and guanidine derivatives of (TRAUBE and SCHALL), A., i, 118.
carbamide and thiocarbamide derivatives of (TRAUBE and LORENZ), A., i, 115.
- Diacetoneguanidine** and its acetyl derivative (TRAUBE and SCHWARZ), A., i, 117.
- Diacetone-tolylthiocarbamide** (TRAUBE and SCHALL), A., i, 118.
- Diaceoxymorphine** (*heroin*), colour test for (KOBERT), A., ii, 121.
- Diaceoxystilbene** (NEF), A., i, 21.
- Diaceoxytetramethylstilbene**, tetra-bromo- (AUWERS, TRAUN, and WELDE), A., i, 168.
- Diacetyl**-. See also under Parent Substance.
- Diacetylacetone**, action of methyl iodide on the sodium derivative of, and orcinol derivatives from (COLLIE and STEELE), T., 961; P., 1900, 146.
- 1:7-Diacetyl-amino- β -naphthol** (KEHRMANN and WOLFF), A., i, 449.
- Diacetylaminophenolsulphonic acid** (COHN), A., i, 29.
- Diacetylanthranilic acid**, methyl ester (ERDMANN), A., i, 188.
- Diacetyldioxime**, compounds of, with certain solvents (PETRENKO-KRITSCHENKO and KASANEZKY), A., i, 350.
- Diacetyl-diphenyl and -ditolyl-ethenyl-amidines** (TRAUBE and EYME), A., i, 119.
- $\beta\beta$ -Diacetylpropionic acid**, methyl and ethyl esters (MARCH), A., i, 374.
- $\alpha\beta$ -Diacetylpyroterebic acid**, ethyl ester (PAULY and LIECK), A., i, 275.
- Diacetyltartaric acid**, diethyl ester, rotation of (McCRAE and PATTERSON), T., 1096; P., 1900, 161.
- Diacylamarines**, constitution of (JAPP and MOIR), T., 632; P., 1899, 212.
- isoDialdane** (DE BRUYN and BIJL), A., i, 205.
- Dialkylamaronium salts**, constitution of (JAPP and MOIR), T., 615; P., 1899, 212.
- Diallage** from Russia (TARASSENKO), A., ii, 26.
- Diamines**, behaviour of, on neutralisation (BERTHELOT), A., i, 83.
- Disoamyl-dibromocamine**, action of silver oxide on (KJNER), A., i, 629.
- Diamyldisulphoneacetonephthalamic acid**, salts of (POSNER and FAHRENHORST), A., i, 17.
- β -Diamyldisulphonepropyl-carbamide**, and -thiocarbamide (POSNER and FAHRENHORST), A., i, 17.
- Dianiline** antimonibromide (HIGBEE), A., i, 285.
stannibromide (RICHARDSON and ADAMS), A., i, 151.
- Dianilinophenylbenzoquinone** (BORSCHKE), A., i, 594.
- Dianilino-orthophosphoric acid**, and di-p-chloro-, and -phosphoryl chloride (AUTENRIETH and RUDOLPH), A., i, 570.
- Dianilinoquinoneanil**, electrolytic preparation of (LÖB), A., i, 464.
- Diantipyrinemethane**. See Formopyrine.
- Diaspartidodiaspartic acid** and its ammonium salts (SCHIFF), A., i, 279.
- Diastase**, decomposition of, during fermentation (HEINZELMANN), A., ii, 230.

- Diastase**, proteolytic, of malt (FERNBACH and HUBERT), A., i, 576.
influence of phosphates and other inorganic compounds on the (FERNBACH and HUBERT), A., i, 616.
- m*-**Diazines**. See Pyrimidines.
- Diaoacetic acid**, ethyl ester, polymerisation products from (HANTZSCH and SILBERRAD), A., i, 261.
- Diaoaminobenzene**, copper derivatives of (MEUNIER and RIGOT), A., i, 316; (MEUNIER), A., i, 571.
- Diaoaminobenzenedi-*p*-sulphonic acid**, isomeric forms of (VAUBEL), A., i, 615.
- Diaoazobenzenetrisulphonic acid**, potassium salt (JUNGHAHN and NEUMANN), A., i, 418.
- Diaobenzene**, action of, on isonitromethane (BAMBERGER, SCHMIDT, and LEVINSTEIN), A., i, 566.
chloride, action of α -methyltetronic acid on (WOLFF and HEROLD), A., i, 585.
nitrate from nitrosophenylhydrazine (RÜGHEIMER), A., i, 532.
- Diaobenzenebenzylamine**, *p*-nitro- (WOHL and SCHIFF), A., i, 708.
- Diaobenzenehydrazides** (WOHL and SCHIFF), A., i, 707.
- Diaobenzene-*m*-hydrazinobenzoic acid** (WOHL and SCHIFF), A., i, 708.
- Diaobenzeneimide**, *pentabromo*- (HANTZSCH and SMYTHE), A., i, 316.
- Diaobenzeneophenylhydrazide** and its halogen derivatives and their oxidation with permanganate (WOHL and SCHIFF), A., i, 707.
- Diaobenzeneopiperidine** and its sulphonic acid, action of bromine on (WALLACH and TEWES), A., i, 265.
- Diaobenzene-*o*-sulphonic acid**. See Benzenediazonium-*o*-sulphonic acid.
- Diaobenzoic acid phenylhydrazide**, *m*- and *p*- (WOHL and SCHIFF), A., i, 708.
- Diaocaffeine** and its derivatives (GUMBERG), A., i, 263.
- Diao-compounds**, nomenclature of the (HANTZSCH), A., i, 702.
normal, as pseudodiazonium compounds (HANTZSCH), A., i, 126.
- Diaoocyanides** (HANTZSCH), A., i, 567, 569.
- syn*-**Diaoocyanides**, interaction of, with cuprous compounds (HANTZSCH and BLAGDEN), A., i, 704.
- Diaoocymene nitrate**, nitroso- (OLIVERI-TORTORICI), A., i, 553.
- Diao-haloids** and -thiocyanates (HANTZSCH), A., i, 568.
- Diaoohydrazides**, preparation, characteristics, and oxidation of (WOHL and SCHIFF), A., i, 706.
- Diaoohydroxides** (ENGLER and HANTZSCH), A., i, 566.
- Diaoohydroxyaminobenzene** (BAMBERGER and STIEGELMANN), A., i, 193.
- Diaoic acids**. See Nitramines.
- Diaolone disulphides**, *dithio*-, action of methyl iodide on, and decomposition of thiodiazolones (BUSCH and LINGENBRINK), A., i, 413.
- 5-Diaolone-1-propionic acid**, 3-amino-, and 5-thio-, ethyl esters (BAILEY and ACREE), A., i, 530.
- Diaomethane**, action of, on β -aromatic hydroxylamines (BAMBERGER and TSCHIRNER), A., i, 342.
action of, on picryl acetate (v. PECHMANN), A., i, 313.
- anti*-**Diaonaphthalene salts** (ENGLER), A., i, 568.
- Diaonaphthalene nitrate**, nitroso- (OLIVERI-TORTORICI), A., i, 553.
- Diaonium** (*benzenediazonium*) salts, constitution of (HANTZSCH), A., i, 126; (BAMBERGER), A., i, 193.
decomposition of (HANTZSCH), A., i, 703.
interaction of, with cuprous compounds (HANTZSCH and BLAGDEN), A., i, 704.
chloride, action of ethereal acylcyanoacetates on (FAVREL), A., i, 532.
action of, on alkaline solutions of nitrosophenol (BORSCHKE), A., i, 24, 595.
chlorides, bromo-, transformation of, into chlorodiazonium bromides (HANTZSCH and SMYTHE), A., i, 315.
cyanides (HANTZSCH), A., i, 567.
hydroxides (ENGLER and HANTZSCH), A., i, 566.
nitrate mercurinitrite (HANTZSCH and BLAGDEN), A., i, 704.
- Diaosalicylic acid** and chloride and sulphonic acid (AUDEN), P., 1899, 231.
- o*-**Diaosalicylic acid** and its reactions (ZAHN), A., i, 549.
- syn*-**Diaotates** (HANTZSCH), A., i, 567.
from *p*-bromobenzenediazonium-*o*-sulphonic acid (GERILOWSKI), A., i, 706.
- iso*-**Diaotates**, new method of preparing (BAMBERGER and MÜLLER), A., i, 705.
- Diaotetronic anhydride** (WOLFF and LÜTTRINGHAUS), A., i, 583.
- Diaotetronosulphonic acid**, salts of (WOLFF and LÜTTRINGHAUS), A., i, 584.

- Diazotisation**, velocity of (SCHÜMANN), A., ii, 264.
 elimination of a nitro-group during (MELDOLA and WECHSLER), T., 1172; P., 1900, 167.
- p*-Diazotoluenephnylhydrazide** and its oxidation with permanganate (WOHL and SCHIFF), A., i, 707.
- p*-Diazotoluenepiperidide**, action of bromine on (WALLACH and TEWES), A., i, 265.
- Dibenzaldehyde diperoxide** (V. BAEYER and VILLIGER), A., i, 627.
- Dibenzeneazo- β -dinaphtholmethane**, Abol's. See Benzeneazo- β -naphthol.
- Dibenzoyl-**. See also under Parent Substance.
- Dibenzoyl-*s*-dibenzyl-*i*-diphenylethylenediamine** (JAPP and MOIR), T., 608; P., 1899, 211.
- Dibenzoyldiphenylcarbamide** (DINGLINGER), A., i, 503.
- s*-Dibenzoyl-*i*-diphenylethylenediamine** (JAPP and MOIR), T., 611; P., 1899, 211.
- s*-Dibenzoylhydrazide** (SILBERRAD), T., 1186; P., 1900, 169; (MINUNNI and CARTA-SATTA), A., i, 252.
 metallic salts of, and conversion of, into azodibenzoyl (STOLLÉ and BENRATH), A., i, 531.
- Dibenzoylmethane** (POND, MAXWELL, and NORMAN), A., i, 102.
 isomeric forms of, and reactions of (WISLICHENUS), A., i, 37.
- Dibenzoylsuccinic acid**, ethyl esters, absorption curves of (HARTLEY and DOBBIE), T., 498; P., 1900, 57.
- Dibenzoyltyrosine** and its salts (SCHULTZE), A., i, 596.
- Dibenzoxo-*o*-benzylideneazaine** (MINUNNI and CARTA-SATTA), A., i, 251.
- Dibenzoxystilbene** (NEF), A., i, 21.
- Dibenzyl**, refraction of (CHILESOTTI), A., i, 339.
 sulphide-mercuric iodide (SMILES), T., 164; P., 1899, 240.
- Dibenzyl-acetoacetic and -cyanoacetic acids**, *p*-dicyano-, ethyl esters (MOSES), A., i, 659.
- Dibenzylacetophenone** (NEF), A., i, 349.
- "**Dibenzylamarine**." See Benzoyl-*s*-dibenzyl-*i*-diphenylethylenediamine.
- Dibenzylamine**, *p*-dicyano- (MOSES), A., i, 659.
- Dibenzylbenzylidenehydrazine** and its *di-o*- and *p*-nitro-derivatives (BUSCH and WEISS), A., i, 699.
- Dibenzylcyanamide**, *p*-dibromo-, constitution of (JACKSON and FULLER), A., i, 482.
- Dibenzylidibenzylidenehydrotetrazone** (CURTIUS), A., i, 611.
- s*-Dibenzyl-*i*-diphenylethylenediamine** (JAPP and MOIR), T., 610; P., 1899, 211.
- Dibenzylformal** (DELEFINE), A., i, 164.
- s*-Dibenzylhydrazine** and its diacetyl, dibenzoyl, and dinitroso-derivatives (CURTIUS), A., i, 611.
- as*-Dibenzylhydrazine**, and its *di-o*- and *p*-nitro- and *di-o*-amino-derivatives and their formyl and acetyl derivatives (BUSCH and WEISS), A., i, 699.
- Dibenzylideneacetonehydroxylamine-oximes**, α - and β -, and the α -acetyl and benzoyl derivatives (MINUNNI and CARTA-SATTA), A., i, 237.
- Dibenzylideneacetone-oxime** and -phenylhydrazone (MINUNNI), A., i, 237.
- Dibenzylidenesuccinic acid** and anhydride, transformation of, into their colourless stereoisomerides (STOBBE), A., i, 659.
- Dibenzyl ketone**, condensation of, with benzaldehyde (GOLDSCHMIEDT and KNÖPPER), A., i, 35.
- Dibenzyl ketone benzylideneanilines** and their hydrochlorides, isomeric (FRANCIS), T., 1191; P., 1900, 169.
- Dibenzyllophonium chloride** (JAPP and MOIR), T., 614; P., 1899, 212.
- Dibenzylmalonic acid**, *p*-dicyano-, ethyl ester (MOSES), A., i, 659.
- Dibenzyl- β -naphthylamine**, and the action of formaldehyde on (MORGAN), T., 825; P., 1900, 131.
- Dibenzylsemicarbazide**, *o*-dinitro- (BUSCH and WEISS), A., i, 700.
- Dibornylloxamide** (FORSTER and HARTSMITH), T., 1152; P., 1900, 166.
- Diisobutyl**. See Octane.
- s*-Diisobutylsuccinic acids**, *cis*- and *trans*-, preparation and dissociation constants of (BONE and SPRANKLING), T., 1299; P., 1900, 184.
- Dicarbonyl cuprous chloride** (JONES), A., ii, 17.
- Di-p*-carboxybenzylacetic acid** (MOSES), A., i, 659.
- Di-p*-carboxybenzylamine hydrochloride** (MOSES), A., i, 659.
- 2,6-Dicarboxyphenol**, 4-nitro-, and its salts (HILL, SOCH, and OENSLAGER), A., i, 539.
- Dichloral peroxide hydrate** (V. BAEYER and VILLIGER), A., i, 627.
- Diocotin** and ψ -Diocotin (HESSE), A., i, 35.
- Dicoumaryl ketone** (STOERMER), A., i, 655.
- Dieranumtannic acid** (CZAPEK), A., i, 556.

- Diemyldimethylmethane**, distillation of, under pressure (KRAEMER and SPILKER), A., i, 617.
- Di-2,4-dimethylbenzyl-amine**, and -hydrazine and their derivatives (CURTIUS), A., i, 613.
- Didymium**, yttrium and erbium, microchemical researches on (POZZI-ESCOT and COUQUET), A., ii, 404.
- salts, effects of dilution, temperature, etc., on the absorption spectra of solutions of (LIVEING), A., ii, 517.
- Dielectric constant**. See Electrochemistry.
- 1-Dierythrossimide** (WOHL), A., i, 140.
- β -Diethiothiobutane**, γ -chloro- (POSNER and FAHRENHORST), A., i, 16.
- β -Diethothio-butyric** and - α -methyl- and - α -ethyl-butyric acids and their ethyl esters (POSNER), A., i, 5.
- β -Diethothioglutamic acid** and its diethyl ester (POSNER), A., i, 6.
- 2,4-Diethoxy- α -acetylacetophenone** (BLOCH and v. KOSTANECKI), A., i, 308.
- 2,4-Diethoxybenzoylacetophenone** (GROSSMANN and v. KOSTANECKI), A., i, 669.
- 2,5-Diethoxy-acetyl- and -benzoyl-acetophenone** (CRIVELLI and v. KOSTANECKI), A., i, 668.
- 3,7-Diethoxychromone** (BLOCH and v. KOSTANECKI), A., i, 308.
- o*-Diethoxydiphenyltetrahydropyrone-oxime** and its compounds (PETRENKO-KRITSCHENKO), A., i, 306.
- 2,2'-Diethoxy-flavone** and -flavanone (v. KOSTANECKI and SEIFART), A., i, 668.
- 3,3'-Diethoxyflavone** (v. HARPE and v. KOSTANECKI), A., i, 238.
- 6,3'-Diethoxy-flavone** and -flavanone (BLUMSTEIN and v. KOSTANECKI), A., i, 448.
- β -Diethoxypropionic acid**, methyl ester (WOHL and EMMERICH), A., i, 628.
- Diethoxysuccinic acid**, ethyl potassium salt, electrolysis of (BROWN and BOLAM), A., i, 201.
- Diethyl sulphide-mercuric iodide** (SMILES), T., 164; P., 1899, 240.
- Diethylacetoxime**, chloro- (IPATIEFF), A., i, 14.
- 2'-Diethylaminocanthraquinone**, 5,6-dichloro- (SEVERIN), A., i, 450, 598.
- 2'-Diethylaminobenzoylbenzoic acid**, 3,4-dichloro-, and its esters (SEVERIN), A., i, 598.
- 2'-Diethylaminobenzylbenzoic acid**, 3,4-dichloro- (SEVERIN), A., i, 450, 598.
- p*-Diethylaminobenzyl-*p*-toluidine** (COHN and FISCHER), A., i, 691.
- Diethyldiaminocresol** and its dihydrochloride (FRIEDL), A., i, 593.
- 2,2'-Diethyldiamino-1:1'-dinaphthylmethane**, and its dibenzoyl derivative (MORGAN), T., 827; P., 1900, 131.
- 7-Diethylamino-4-methylcoumarin** and its tribromo-derivative (v. PECHMANN; v. PECHMANN and SCHAAL), A., i, 174.
- p*-Diethylaminophenylacetic acid**, its salts and reduction (EINHORN), A., i, 227; (EINHORN and PAPASTAVROS), A., i, 228.
- 4-Diethylaminophenyl- μ -cyanoasomethine-carboxylamide**, -carboxylonitrile, and -phenyl (SACHS), A., i, 362.
- Diethylaniline**, action of cyanogen bromide on (SCHOLL and NÖRR), A., i, 435.
- action of thionyl chloride on (MICHAELIS and SCHINDLER), A., i, 216.
- p*-Diethylaminophenylcarboxylic acid**. See *p*-Diethylaminophenylacetic acid.
- β -Diethyldisulphoneglutaric acid**, ethyl ester (POSNER), A., i, 6.
- α -Diethyldisulphonepropionic acid**, ethyl ester (POSNER), A., i, 5.
- β -Diethyldisulphonepropyl-carbamide**, and -thiocarbamide (POSNER and FAHRENHORST), A., i, 16.
- γ -Diethyldisulphonewaleric acid** (POSNER), A., i, 6.
- Diethylenediamine** (*piperazine*) and its hydrate (BERTHELOT), A., i, 83.
- Diethylenediaminechromium salts**, dithiocyano- (PFEIFFER), A., i, 688.
- Diethylenediaminecobalt salts** (WERNER, MÜLLER, KLIEN, and BRÄUNLICH), A., i, 86.
- Diethylenediaminenickel salts** (KURNAKOFF), A., i, 209.
- Diethylenediaminepalladiodichloride** (KURNAKOFF and GWOSDAREFF), A., i, 209.
- Diethylenedisulphidethetine** and its salts (STRÖMHOLM), A., i, 12.
- Diethylethylidenedisulphone** (POSNER), A., i, 5.
- Diethylhydroxylamine** (LACHMAN), A., i, 380.
- β -Diethylhydroxylamine** and its salts (BEWAD), A., i, 630.
- Diethylketonedithyldisulphone**, chloro- (POSNER and FAHRENHORST), A., i, 17.
- Diethyl- α - and - β -naphthylamines**, and the action of formaldehyde on (MORGAN), T., 823; P., 1900, 131.
- Diethylsulphonedimethylmethane**. See Sulphonal.
- Diethyltetrahydro-8-naphthylamine**, action of formaldehyde on (MORGAN), T., 824.

- Diethyluric acid and its salts** (ARMSTRONG), A., i, 636.
- DIFFUSION** :—
- Diffusion**, theory of (WIEDEBERG), A., ii, 194.
- of various substances, influence of animal membrane on the (HEDIN), A., ii, 221.
- of a solid into a gas (COLSON), A., ii, 241.
- Diffusion velocity** and electromotive force, influence of the addition of a salt with one similar ion on (ABEGG and BOSE), A., ii, 127.
- Osmotic pressure**, definition of (BROWN), A., ii, 194.
- simple proof of van't Hoff's law of (IKEDA), A., ii, 391.
- extent to which the interaction of ionic charges diminishes (V. TÜRIN), A., ii, 712.
- of concentrated solutions (EWAN), A., ii, 195.
- action of increased, on the ovum (BATAILLON), A., ii, 554.
- Digestibility** of white and whole-meal breads (ROSENHEIM and SCHIDROWITZ), A., ii, 289.
- of butter and margarine in the human intestine (LÜHRIG), A., ii, 224, 667.
- relative, of certain fats in the human intestine (LÜHRIG), A., ii, 224, 355, 667.
- Digestion**, influence of "saccharin" on (BERLIOZ), A., ii, 606.
- gastric, end products of (PFAUNDLER), A., ii, 666.
- peptic (SCHÜTZ and HUPPERT), A., ii, 553.
- estimation of products of (EFFRONT), A., ii, 59.
- of albumin and fibrin by papain (HARLAY), A., i, 419.
- of carbohydrates by Aplysia (RÖHMANN), A., ii, 289.
- of proteids by pepsin or trypsin, influence of alcohols on (LABORDE), A., ii, 151.
- by trypsin, action of arginine on the (LAWBOFF), A., ii, 28.
- of starch in the stomach of Carnivora (FRIEDENTHAL), A., ii, 224.
- in birds (PAIRA-MALL), A., ii, 553.
- Digestive juice**, bile as a (BRUNO), A., ii, 553.
- Dihydroanthracene-2-carboxylic acid**, (LIMPRICHT and LACH), A., i, 31.
- Dihydroasthiotetride**, 2:4-dicyano- and its acetyl derivative; and **Dihydroasthiotetride-4-aminoxime**, 2-cyano- and its acetyl derivatives (HELLSING), A., i, 519.
- Dihydrocamphenes** (SEMMLER), A., i, 351.
- Dihydrocampholenic acid**, its nitrile and amide (MAHLA and TIEMANN), A., i, 507.
- Dihydrocampholytic acid**, β -bromo- (NOYES and PHILLIPS), A., i, 622.
- Dihydrocarveol acetate and chloride** (KLAGES and KRAITH), A., i, 44.
- Dihydrocarvone** (KONDAKOFF and LUTSCHININ), A., i, 104.
- chloride, physical constants of (KLAGES and KRAITH), A., i, 43.
- Dihydrocinchonine**, reactions of (KÖNIGS), A., i, 246.
- Dihydrocinna-m-hydroxamic acid** and its acyl derivatives (THIELE and PICKARD), A., i, 30.
- Dihydrocuminyl alcohol** (SEMMLER), A., i, 454.
- Dihydrocymene**, 2-chloro-, and 2-chloro-bromo- (KLAGES and KRAITH), A., i, 43.
- Dihydrodiazotetronic anhydride** (WOLFF and LÜTTINGHAUS), A., i, 584.
- Dihydrodithiazine derivatives** (HELLSING), A., i, 518.
- Dihydroeucarveol acetate and chloride** (KLAGES and KRAITH), A., i, 43.
- Dihydroisolauronamines** and their derivatives (BLANC), A., i, 239.
- Dihydroiselauronic acid**, constitution of (BLANC), A., i, 329.
- Dihydropyrasine-2:3-diacetic acid**, ethyl ester (THOMAS-MAMERT and WEIL), A., i, 459.
- Dihydropyridinedicarboxylic acids**, substituted, ethyl esters, action of heat on (GUARESCHI and GRANDE), A., i, 112.
- Dihydroresorcinol**, compounds of, with aldehydes (VORLÄNDER and KALKOW), A., i, 99; (VORLÄNDER and STRAUSS), A., i, 100.
- Dihydrotetrasinedicarboxylic acid** (HANTZSCH and SILBERRAD), A., i, 262.
- Dihydrotetrasines** (*bisdiazomethane*) (HANTZSCH and SILBERRAD), A., i, 262.
- Dihydroxamic acid**, imino- (BAMBERGER and MÜLLER), A., i, 145.
- Dihydroxybenziloazone**, *tetrabromo-* (BILTZ), A., i, 663.
- 3:4-Dihydroxybenzoic acid**. See *Protocatechuic acid*.
- 2-mp-Dihydroxybenzylidene-5-methoxy-7-methyl-1:3-diketohydrindene-4-carboxylic acid**, methyl ester (LANDAU), A., i, 662.
- Dihydroxybutanetetra-carboxylic acid**, and its δ -lactone (LEAN), T., 104, 108; P., 1899, 197.

- Dihydroxycerackene** (KLAUDY and FINE), A., i, 284.
- Dihydroxydiazobenzene**, dinitro-dicyano-, and its salts and their reduction (NIETZKI and PETRI), A., i, 486.
- p-Dihydroxydimesitylether**, tetrabromo-, its diacetate and dimethyl derivative (AUWERS and TRAUN), A., i, 168.
- αγ-Dihydroxy-αβ-dimethylpropane** (pentaglycol:1:2-dimethylpropan-1:3-diol) and its diacetyl derivative (SCHMALZHOFFER), A., i, 626.
- αγ-Dihydroxy-βδ-dimethylpropane** (pentaglycol:βδ-dimethylpropan-1:3-diol), action of sulphuric acid on (FISCHER and WINTER), A., i, 472.
- 2:5-Dihydroxydiphenyl** (BORSCHKE), A., i, 594.
- Dihydroxydiphenylmethane-2:4'-dicarboxylic acid** (LIMPRICHT and LACH), A., i, 32.
- 2:2-Dihydroxyflavone** and its diacetyl derivative (v. KOSTANECKI and SKI-FART), A., i, 668.
- 3:3-Dihydroxyflavone** and its diacetyl derivative (v. HARPE and v. KOSTANECKI), A., i, 237.
- 6:3-Dihydroxyflavone** and its diacetyl derivative (BLUMSTEIN and v. KOSTANECKI), A., i, 448.
- Dihydroxylamine derivatives**, non-existence of (DIVERS and HAGA), T., 437; P., 1900, 54.
- Dihydroxylaminesulphonates**, non-existence of (DIVERS and HAGA), T., 437; P., 1900, 54.
- 3:5-Dihydroxyanisole hydrochloride**, 2:4-diamino- and its tetraacetyl derivative (WEIDEL and POLLAK), A., i, 290.
- 2:7-Dihydroxy-8-methoxy-3-o-methoxyphenylquinoline** (PSCHORR), A., i, 234.
- 4:7(?) Dihydroxy-2-methylquinoline** and its diacetyl derivative (v. PECHMANN), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.
- Dihydroxynaphthalene**, 1:2- and 1:4- derivatives of (RUSSIG), A., i, 601.
- 1:2-Dihydroxynaphthalene-3-carboxylic acid** and its diacetyl derivative (RUSSIG), A., i, 602.
- 1:4-Dihydroxynaphthalene-2-carboxylic acid** and its acetyl derivative (RUSSIG), A., i, 601.
- Dihydroxy-β-naphthaquinone**. See Naphthazarin.
- 3:4-Dihydroxyphenanthrene**. See Morphol.
- p-Dihydroxyphthalimide** (THIELE and MEISENHEIMER), A., i, 299.
- 2:6-Dihydroxypyridine-4-carboxylic acid**. See Citrazinic acid.
- 2:6-Dihydroxypyridine-3:4-dicarboxylic acid**, ethyl ester (RUHEMANN and STAPLETON), T., 243; P., 1900, 12.
- 2:6-Dihydroxypyrimidine**, 4-mono- and 4:5-di-amino- (TRAUBE), A., i, 416.
- Dihydroxystearic acid**, action of fused potash on (LE SUEUR), P., 1900, 91.
- 3:5-Dihydroxytoluene**. See Orcinol.
- Dihydroxytrimesic acid** (resorcinol-1:3:5-tricarboxylic acid), and its esters (ERRERA), A., i, 34.
- Dihydroxy-o-xylene**, tribromo-, and its acetyl derivatives (AUWERS and ERG-GELET), A., i, 98.
- Dihydroxy-m-xyloquinone** (BRUNN-MAYR), A., i, 292.
- Diindone-acetic acid**, -acetone, -acetophenone, and -benzoylacetone (SCHLOSSBERG), A., i, 665.
- Diindone-cyanoacetic acid** and -malononitrile (SCHLOSSBERG), A., i, 666.
- Diketobutyrolactone**, osazone, phenylhydrazone, and phenylhydrazoxime of (WOLFF and LÜTTRINGHAUS), A., i, 584.
- 1:3-Dikohydrindene** and its nitrosite (SCHMIDT), A., i, 299.
- Diketones**, electro-synthesis of (HOFER), A., i, 276.
- α-Diketones**, conversion of ketones into (PONZIO), A., i, 588.
- β-Diketones**, cyclic (LESER), A., i, 430.
- halogen-substituted indone derivatives of (LANSER and WIEDERMANN), A., i, 666.
- halogen-substituted α-naphthaquinolyl derivatives of (MICHEL), A., i, 669.
- halogen-substituted β-naphthaquinolyl derivatives of (HIRSCH), A., i, 670.
- 2:5-Diketotetrahydrothiazole** (WHEELER and BARNES), A., i, 565.
- α-Diketoximes**, characterisation of, by their diacetyl derivatives (PONZIO), A., i, 588.
- Di-2:6-lutidyl-4 sulphone** (MARCKWALD, KLEMM, and TRABERT), A., i, 457.
- Dilution law**. See Affinity.
- Dimethylamine** and its nitrosoamine (KIJNER), A., i, 279.
- Dimesityl**. See s-Tetramethyldibenzyl.
- Dimesitylodonium hydroxide and salts** (WILLERBODT and ROGGATZ), A., i, 432.
- 3:5-Dimethoxybenzoic acid**, ethyl ester, nitro- and amino- (EINHORN), A., i, 441.
- 3:5-Dimethoxycarbonyl-2-aminophenol** (WEIDEL and POLLAK), A., i, 290.
- o-Dimethoxydiphenyltetrahydroxyronoxime** and its compounds (PETRENKO-KRITSCHENKO), A., i, 306.
- 2:6-Dimethoxy-4-methylpyrimidine** (GABRIEL and COLMAN), A., i, 53.

- 1:4-Dimethoxynaphthalene (RUSSIG), A., i, 602.
- 2:3-Dimethoxyphenanthraquinone and its dibromo-derivative (PSCHORR and BUCKOW), A., i, 489.
- 2:3-Dimethoxyphenanthrene, synthesis of, and its dibromo-derivative and 9-carboxylic acid (PSCHORR and BUCKOW), A., i, 489.
- 3:4-Dimethoxyphenanthrene, synthesis of, and its 9-carboxylic acid (PSCHORR and SUMULEANU), A., i, 487.
- identity of, with dimethylmorphol (VONGERICHTEN), A., i, 488.
- 3:5-Dimethoxyphenol hydrochloride, 2- and 4-amino- (WEIDEL and POLLAK), A., i, 290.
- 5:6-Dimethoxy-3-phenyl-1-carbostyryl (PSCHORR and BUCKOW), A., i, 489.
- 7:8-Dimethoxy-3-phenylcarbostyryl (PSCHORR and SUMULEANU), A., i, 487.
- o*-Dimethoxyphthalic acid. See *Meta*-hemipinic acid under Hemipinic acid.
- 3:5-Dimethoxy-*o*- and -*p*-quinoneoximes (WEIDEL and POLLAK), A., i, 290.
- 3:4-Dimethoxystilbene, 2-nitro- (PSCHORR and SUMULEANU), A., i, 487.
- Dimethyl sulphate, alkylation by means of (ÜLLMANN and WENNER), A., i, 619.
- sulphide-mercuric iodide (SMILES), T., 164; P., 1899, 240.
- Dimethylacetyl sulphine iodide and platinichloride (STRÖMHOLM), A., i, 326.
- Dimethylacetoacetic acid, ethyl ester, hydrolysis of (GOLDSCHMIDT and OSLAN), A., i, 373.
- Dimethylacetylacetonitrile (HENRY), A., i, 538.
- Dimethylacridinium hydroxide (HANTZSCH and KALE), A., i, 114.
- Dimethylallylcarbinol, hydrocarbon, C_8H_{16} , from (LUBARSKY), A., i, 422.
- Dimethylallylmalonic acid, ethyl ester, nitrosate of (IPATIEFF), A., i, 3.
- "Dimethylamarine." See Benzoyl-*s*-dimethyl-*i*-diphenylethylenediamine.
- Dimethylamine cadmium haloids (RAGLAND), A., i, 141.
- hydrochloride and hydrobromide, compounds of, with tellurium halogen salts (NORRIS and MOMMERS), A., ii, 537.
- tin haloids (COOK), A., i, 142.
- 2-Dimethylaminocanthraquinone, 5:6-dichloro- (SEVERIN), A., i, 450, 598.
- Dimethylaminobenzene-6-azoquinoline (KNEUPPEL), A., i, 188.
- 2'-Dimethylaminobenzoylbenzoic acid, 3:4-dichloro-, and its esters (SEVERIN), A., i, 296, 445, 450.
- 2'-Dimethylaminobenzylbenzoic acid, 3:4-dichloro- (SEVERIN), A., i, 445, 450.
- p*-Dimethylaminobenzyl-*p*-toluidine (COHN and FISCHER), A., i, 690.
- Dimethyldiaminochlorophenazine (COHN and FISCHER), A., i, 459.
- Dimethylaminodimethylpyrazolone. See Pyramidone.
- 4'-Dimethylaminodiphenylmethane, 4-amino- (COHN and FISCHER), A., i, 691.
- 3-Dimethylaminoflavinduline salts, 2-amino- (KEHRMANN and STOFFEL), A., i, 254.
- 7-Dimethylamino-4-methylcoumarin and -3-ethylcoumarin (v. PECHMANN; v. PECHMANN and SCHAAL), A., i, 173.
- 6-Dimethylamino-3-methylcoumarone and -coumarilic acid (v. PECHMANN; v. PECHMANN and SCHAAL), A., i, 173.
- 4-Dimethylaminophenyl-4-*mono*- and -2':4'-*di*-amino-*m*-tolylmethane (COHN and FISCHER), A., i, 691.
- 4-Dimethylaminophenyl- μ -cyanoazo-methine-carboxylamide, and -carb-oxylonitrile (SACHS), A., i, 362.
- 9-Dimethylamino-7-phenylnaphthazene-azanium salts, 10-amino- (KEHRMANN and VALENCIEN), A., i, 255.
- Dimethylaminophenyl-methyl- and ethyl-sulphones (MICHAELIS and SCHINDLER), A., i, 215.
- aa*-Dimethyl- α -isocamylsuccinic acid, preparation and dissociation constant of (BONE and SPRANKLING), T., 1306; P., 1900, 184.
- Dimethylaniline, action of cyanogen bromide on (SCHOLL and NÖRR), A., i, 485.
- action of methyl chloroacetate on (CENSI), A., i, 363.
- nitration of (VAN ROMBURGH), A., i, 214.
- action of thionyl chloride on (MICHAELIS and SCHINDLER), A., i, 215.
- stannochloride (RICHARDSON and ADAMS), A., i, 151.
- Dimethylaniline, nitroso-, compound of, with tetramethyldiaminodiphenylmethanesulphone (SACHS), A., i, 362.
- o*-Dimethyl-anthranol and -anthraquinone (LIMPRICHT), A., i, 599.
- 2:4-Dimethylbenzaldazine and its reduction (CURTIUS), A., i, 612.
- Di-p*-methylbensylamine and its salts (CURTIUS), A., i, 611.
- o*-Dimethyl-*o*-benzylbenzoic acid (LIMPRICHT), A., i, 599.
- Di-p*-methylbensyldi-*p*-methylbensyldienehydrotetrazone (CURTIUS), A., i, 612.

- s-Di-p-methylbenzylhydrazine** and its derivatives (CURTIUS), A., i, 612.
- Dimethyl-di-bromo- and -chloro-methyl-sulphines** and their salts (STRÖMHOLM), A., i, 14.
- $\beta\beta$ -Dimethylbutane.** See Hexane.
- Dimethylbutanetricarboxylic acid**, ethyl ester, action of sodium and methyl iodide on (PERKIN and THORPE), P., 1900, 152.
- 1:3-Dimethyl-5-butylbenzene.** See Butylxylene.
- $\alpha\alpha$ -Dimethyl- α_1 -isobutylsuccinic acid**, and its α' -cyano-derivative (LAWRENCE), P., 1900, 155.
- preparation and dissociation constant of (BONE and SPRANKLING), T., 1304; P., 1900, 184.
- Dimethyleoumarones**, isomeric (STOERMER), A., i, 651.
- α -Dimethylisocrotonic acid** (2-dimethyl-3-butenoic acid) (BOUVEAULT), A., i, 131.
- Dimethyldiacetylacetone** (COLLIE and STEELE), T., 961; P., 1900, 146.
- Dimethyldihydropyridinedicarboxylic acid**, ethyl ester, action of heat on (GUARESCHI and GRANDE), A., i, 118.
- Dimethyldihydro-1:2:3:4-tetrazine.** See Dimethylsotetrazine.
- s:3:6-Dimethyldihydro-1:2:4:5-tetrazine** and the action of heat and of benzoic chloride on (SILBERRAD), T., 1185; P., 1900, 169.
- Dimethylene-galactonic and -xylonic acids** (CLOWES and TOLLENS), A., i, 205.
- Dimethylenimine** (MARCKWALD), A., i, 336.
- Dimethyl-3- and -2-ethylindolenines**, 1:3- and 2:3-, action of methyl iodide on (PLANCHER), A., i, 560.
- 1:3-Dimethyl-3-ethyl-2-methylenindoline** and its hydriodide (PLANCHER), A., i, 561.
- $\alpha\alpha$ -Dimethyl- α_1 -ethylsuccinic acid**, preparation and dissociation constant of (BONE and SPRANKLING), T., 1305; P., 1900, 184.
- Dimethylethylsulphine iodide** (STRÖMHOLM), A., i, 326.
- iodide mercuric iodide (SMILES), T., 162, 167; P., 1899, 240.
- Dimethylfulvene** (THIELE), A., i, 299.
- Dimethylfumaric acid** (butylenedicarboxylic acid), from dimethylmaleic anhydride (MOLINARI), A., i, 374.
- $\alpha\alpha$ -Dimethylglutaconic acid** (pentylenedicarboxylic acid), synthesis of (CONRAD), A., i, 475.
- $\alpha\beta$ -Dimethylglutolactonic acids**, *cis*- and *trans*-, and their nitriles (BLAISE), A., i, 474.
- $\alpha\alpha'$ -Dimethylglutaric acids** (pentanedicarboxylic acids) (THORPE), T., 933; (HOWLES, THORPE, UDALL, and NEALE), T., 948; P., 1900, 116.
- $\beta\beta$ -Dimethylglutaric acid** (pentanedicarboxylic acid), $\alpha\alpha'$ -dibromo-, ethyl ester, condensation of, with ethyl sodiomalonate (PERKIN, THORPE, and WALKER), P., 1900, 149.
- Dimethylcyclohexanecarboxylic acid** (hexahydroxylic acid) and its isomeride (LEES and PERKIN), P., 1900, 20.
- $\gamma\delta$ -Dimethyl- β -hexenoic acid** (oclenoic acid) and its ethyl ester (BLAISE), A., i, 330.
- Dimethylhippuroflavin.** See Toluroflavin.
- 1:1-Dimethyl-2-methylenepyrrolidinium hydroxide** and salts (WILLSTÄTTER), A., i, 249.
- Dimethylmorphol.** See 3:4-Dimethoxyphenanthrene.
- Dimethyl- α - and - β -naphthylamines** and the action of formaldehyde on (MORGAN); T., 822; P., 1900, 131.
- $\beta\delta$ -Dimethyloctane- ϵ -olide** and its isomeride (V. BAEYER and SEUFFERT; V. BAEYER and VILLIGER), A., i, 132, 133.
- Dimethylol-5-methylacridine** (KOENIGS), A., i, 190.
- Dimethylsotetrazine** (dimethyldihydro-1:2:3:4-tetrazine), and its benzoyl derivatives (V. PECHMANN and BAUER), A., i, 314.
- $\beta\delta$ -Dimethyl- $\beta\delta$ -pentadiene.** See Heptinene.
- $\beta\delta$ -Dimethylpentane.** See Heptane.
- Dimethylphenomorpholone** (BISCHOFF), A., i, 346.
- Dimethylphenonaphthacridinium salts**, amino- ("aminodimethylnaphthacridinium" salts) (ULLMANN and NAEF), A., i, 689.
- Dimethyl-1:2:3:5-pentetrol**, preparation of, and its tetracetyl derivative (BRUNNMAYER), A., i, 291.
- Dimethylphloroglucinol**, bromo-, and its triacetyl derivative (HERZIG, POLLAK, and ROHM), A., i, 595.
- nitroso- and amino- and its pentacetyl derivative (BRUNNMAYER), A., i, 292.
- 1:1-Dimethylpiperidine**, action of halogens on (WILLSTÄTTER), A., i, 249.
- 2:4-Dimethylpiperidine** (2:4-lupetidine), decomposition of, into its optical isomerides (ENGELS), A., i, 406.
- Dimethylpropandiol.** See Dihydroxydimethylpropane.
- 4:4-Dimethyl-5-isopropylpyrazoline**, and its acetyl and benzoyl derivatives (FRANKE), A., i, 212.

- αα*-Dimethyl-*α*,*γ*- and -*iso*-propylsuccinic acids**, preparation and dissociation constant of (BONE and SPRANKLING), T., 1805; P., 1900, 184.
- 2:6-Dimethylpyrazine**, absorption spectrum of (HARTLEY and DOBBIE), T., 846; P., 1900, 129.
- 2:6-Dimethylpyridine** (*lutidine*), 3:5-diamino- (MOHR), A., i, 409.
- 3-chloro- and 3-bromo-, and their salts (BOCCHI), A., i, 357.
- 2:6-Dimethylpyridine-3:5-dicarboxylic acid**, diethyl ester, conversion of, into 3:5-diaminolutidine (MOHR), A., i, 409.
- 2:6-Dimethylpyridyl 4-mercaptan**, 4-methosulphide, sulphides, and acetyl sulphide and its oxime (MARCKWALD, KLEMM, and TRABERT), A., i, 457.
- 2:6-Dimethylpyridyl-4-methylsulphone**, and 4-sulphonic acid (MARCKWALD, KLEMM, and TRABERT), A., i, 457.
- Dimethylpyrone**, action of sodium ethoxide on (COLLIE and STEELE), T., 970; P., 1900, 146.
- action of iodine on the barium and sodium salts of, and its periodide (COLLIE and STEELE), T., 1114; P., 1900, 164.
- Dimethylpyronedicarboxylic acid**, ethyl ester, reduction of, and the action of semicarbazide on (OLIVERI-TORTORICI), A., i, 552.
- Dimethylpyrrolines**, action of bromoform and chloroform on (BOCCHI), A., i, 357.
- Dimethylstyrene**, 2:4- and 2:5-, *αβ*-dichloro- (KUNCKELL and GOTSCH), A., i, 639.
- αα*-Dimethylsuccinic acid** and anhydride (PERKIN, THORPE, and WALKER), P., 1900, 149.
- αα*-Dimethylsuccinic acids**, preparation and dissociation constants of (BONE and SPRANKLING), T., 1204; P., 1900, 184.
- Dimethyltetroxan**, hexabromo- (PINNER), A., i, 427.
- αα*-Dimethylthionine** and its salts (SCHAFOSCHNIKOFF), A., i, 524.
- Dimethyltoluenesammonium silver iodide** (ROSER), A., i, 51.
- 3:5-Dimethyl-1:2:4-triazole**, synthesis of, and its hydrochloride and nitrate (SILBERRAD), T., 1187; P., 1900, 169.
- αα*-Dimethyltricarballic acid**, and the ethyl ester of the *β*-cyano-derivative, synthesis of (HALLER and BLANC), A., i, 475.
- 4-Dimethyltrimethylenedicarbonimide**, 3:5-dicyano- (GUARESCHI and GRANDE), A., i, 111.
- Dimethyltrioxin**, hexabromo- (PINNER), A., i, 427.
- β-Dimethyluracil** (BEHREND and DIETRICH), A., i, 120; (BEHREND), A., i, 287.
- Dimethylvinylideneoxanilide** (v. PECHMANN and ANSEL), A., i, 287.
- Dimethylxylidines**, isomeric, methiodides of (FISCHER and WINDAUS), A., i, 224.
- Dimorphism** of cyanocamphor and its chloro- and bromo-derivatives (LAPWORTH), T., 1059; P., 1900, 128.
- Dimorphous substances**, monotropic, determination of the transition temperature of (SCHENCK), A., ii, 465.
- Dinaphthanthracene**, $C_{22}H_{14}$ (RUSSIG), A., i, 602.
- β-Dinaphtholmethane**, dinitroso-, Abel's. See *β*-Naphthol, *α*-nitroso-.
- αα*-Dinaphthoxyethane** (FOSSE), A., i, 298.
- 1:1'-Dinaphthyl**, 4:4'-diiodo-, and its reactions (WILLGERODT and SCHLÖSSER), A., i, 282.
- α*-Dinaphthylbenzidine**, action of tetramethyldiaminobenzophenone on (MERZ and STRASSER), A., i, 314.
- s*-Dinaphthylcarbamides**, *α*- and *β*- (VITTENET), A., i, 153.
- ββ*-Dinaphthylcarbaside** (CAZENEUVE and MOREAU), A., i, 196.
- Dinaphthyl-*m*- and -*p*-phenylenediamines**, *α*- and *αβ*- (MERZ and STRASSER), A., i, 253.
- Diocetylamine** and its nitroso-compound (KIJNER), A., i, 278.
- Dionine**. See Morphine ethyl ether.
- 2:6-Dioxy-4-dimethylpiperidine** and its derivatives (GUARESCHI and GRANDE), A., i, 112.
- 2:6-Dioxy-4-methyl-4-hexylpiperidine**, and its derivatives (GUARESCHI and GRANDE), A., i, 112.
- 2:6-Dioxy-4-methyl-4-*n*- and -*iso*-propylpiperidines** (*ββ*-methyl-*n*- and -*iso*-propylglutarimides), 3:5-dicyano- and their salts and derivatives (MINOZZI), A., i, 407.
- 2:5-Dioxy-4-methylpurine**, 7-amino-, and 7-chloro-, and their derivatives (FISCHER and ACH), A., i, 64.
- Diphenacetyl tartaric acid**, diethyl ester, rotation of (McCRAE and PATTERSON), T., 1096; P., 1900, 161.
- Diphenacylacetic acid**, *γ*-lactone of (KLOBB), A., i, 406.
- s*-Diphenethylcarbamide** (THIELE and PICKARD), A., i, 30.
- Di-*p*-phenetidinophosphoric acid** (AUTENRIETH and RUDOLPH), A., i, 570.
- Diphenetylisothiocarbamide**, acyl derivatives (HUGESHOFF), A., i, 156.
- αα*-Diphenoxyethane** (FOSSE), A., i, 298.

- as*-Diphenoxysuccinic acid, ethyl ester (RUHEMANN and BEDDOW), T., 1121; (RUHEMANN and STAPLETON), T., 1183; P., 1900, 168.
- Diphenyl (PELLEGRIN), A., i, 151.
- Diphenylamine sulphoxide, *p*-nitro- (SCHAPOSCHNIKOFF), A., i, 523.
- Diphenylamine, triamino-, benzylidene derivatives of (GRONEBERG), A., i, 260.
- Diphenylamine-mono- and -di-sulphonic acids (GNEHM and WERDENBERG), A., i, 93.
- Diphenylazoethylenetrimethylenediamine (ESCH and MARCKWALD), A., i, 336.
- 3:4-Diphenyl-3:4-A²-benzasoxazine and its nitro-derivatives (WERNER and HERBERGER), A., i, 58.
- 2:6-Diphenylbenzo-quinol and -quinone (BORSCHKE), A., i, 25, 594; (HILL), A., i, 392; (HILL, SOCH, and OENSLAGER), A., i, 538.
- γ -Diphenyl- α -benzylideneitaconic acid, transformation of, into colourless stereoisomerides (STOBBE), A., i, 660.
- α -Diphenylbutenylamidine (DAINS) A., i, 391.
- Diphenylcarbamide (*carbanilide*), thio-, action of hydrazine on (BUSCH), A., i, 27; (BUSCH and BAUER), A., i, 414.
- Diphenylcarbaside (CAZENEUVE and MOREAU), A., i, 196.
as a sensitive reagent for metals (CAZENEUVE), A., ii, 627.
- Diphenylcarbasone, tinctorial properties of (CAZENEUVE and SISLEY), A., i, 701.
metallic compounds of (CAZENEUVE), A., i, 465.
- Diphenyleyanamide, action of ammonia on (v. BRAUN), A., i, 643.
- Diphenyldiasoxole, preparation and isolation of (SILBERRAD), T., 1188; P., 1900, 169.
- 2:5-Diphenyldiethylenetetrahydropyrone-3-carboxylic acid and its derivatives (COEN), A., i, 307.
- 3:3:6-Diphenyldihydrotriazine (SILBERRAD), T., 1188; P., 1900, 169.
- Diphenyldiketopiperazine, formation of, and indigotin from (KUHARA and CHIKASHIGE), A., i, 560.
- Diphenyldimethylcarbaside (CAZENEUVE and MOREAU), A., i, 196.
- Diphenyl-dimethyl- and -dibenzyl-tetrazones (McPHERSON), A., i, 124.
- o*-Diphenylene oxide, 3:5-dinitro- (*di-nitrophenoxozone*) (HILLYER), A., i, 289.
- Di-*m*-phenylenediethene (?) (PELLEGRIN), A., i, 151.
- s*-Diphenylethylene. See Stilbene.
- Diphenylethylenediamine, its nitro-derivatives, nitrate and mercurichloride (MILLS), T., 1020; P., 1900, 127.
- dicyano- (TRAUBE and v. WEDEL-STÄDT), A., i, 390.
- i*-Diphenylethylenediamine (m. p. 120-121°), action of nitrous acid on (JAPP and MOIR), T., 642.
- 2:5-Diphenylethylenetetrahydropyrone-3-carboxylic acid (COEN), A., i, 307.
- Diphenylethylisothiocarbamide, its acetyl and benzoyl derivative and additive compound with acetic anhydride (DAINS), A., i, 391.
- Diphenylfulvene (THIELE), A., i, 299.
- Diphenylfurfuran (AMEYE), A., i, 35.
- Diphenylguanidine, amino-, reactions of (BUSCH and BAUER), A., i, 414.
p-chloroamino- (BUSCH), A., i, 27.
- Diphenyl-*o*-hydroxybenzylidenehydrazine (LABHARDT and v. ZEMBRZUSKI), A., i, 125.
- Diphenylimine, inimothio-, compounds of, with amines (SCHAPOSCHNIKOFF), A., i, 523.
- 2:3-Diphenyl-5-mesityl-furfuran and -pyrrole (SMITH), A., i, 39.
- Diphenylmethane derivatives, preparation of (COHN), A., i, 608.
hydrogenised derivatives (VORLÄNDER), A., i, 99.
- Diphenylmethane-*p*-cyano- and Diphenylmethane-*p*-carboxylic acid (MOSES), A., i, 659.
3:3'-dinitro-4:4'-diamino-, and 3:4:3':4'-tetramino- (MEYER and ROHMER), A., i, 222.
- Diphenylmethane-3:4'-dicarboxylic acid (LIMPRICHT and LACH), A., i, 31.
- Diphenylmethane diphenyl and ditolyl diketone (LIMPRICHT and LACH), A., i, 31.
- Diphenylmethylenedihydroxylamine, and *di-p*-chloro- and -bromo- (BAMBERGER), A., i, 341.
- Diphenylmethyloxyde (AUGER), A., i, 594.
- 2:3-Diphenyl-5- α -naphthyl-furfuran, -pyrrole, and -thiophen (SMITH), A., i, 38.
- Diphenyl-*o*-, -*m*-, and -*p*-nitrobenzylidenehydrazines (LABHARDT and v. ZEMBRZUSKI), A., i, 125.
- Diphenylcetoxyhydro-xanthenedione (VORLÄNDER and KALKOW), A., i, 100.
- 3:5-Diphenylisooxazole and its oxime (WISLICENUS), A., i, 38.
- 1:2-Diphenyl-4-phenacylpyrrolone and its polymeride (KLOBB), A., i, 406.
- 2:6-Diphenylphenol, 4-nitro-, its potassium derivative, and methyl ether (HILL, SOCH, and OENSLAGER), A., i, 538.

- 2:6-Diphenylphenol**, 4-nitro- and 4-amino- (HILL), A., i, 392; (HILL, SOCH, and OENSLAGER), A., i, 538.
- Diphenylphthalide**, dithio- (MEYER; MEYER and SZANECKI), A., i, 660.
- 3:5-Diphenylpyrazole** (WISLICIENUS), A., i, 38.
- Diphenylpyrimidone** (RUHEMANN and STAPLETON), T., 239; P., 1900, 11.
- Diphenyl-quinol and -quinone**. See Diphenylbenzo-quinol and -quinone.
- 1:2-Diphenyltetrahydro- β -naphthenone** and its oxime (GOLDSCHMIEDT and KNÖPPER), A., i, 35.
- Diphenyltetrahydropyrronedicarboxylic acid**, ethyl esters, isomeric, and their methyl derivatives (PETRENKO-KRITSCHENKO and ELTOCHANINOFF), A., i, 307.
- Diphenyltetrahydropyroneoxime** and its compounds and benzoyl derivative (PETRENKO-KRITSCHENKO), A., i, 307.
- Diphenyltetrasonium chloride**, action of acetylanacetic esters on (FAVREL), A., i, 532.
- Diphenylisothiocarbamide**, acyl derivatives (HUGERSHOFF), A., i, 156.
- Diphenylthiosemicarbazide**, action of chloroacetic acid on (V. WALTHER and STENZ), A., i, 569.
- Diphenylsuccinic acid**, dithio-, ethyl ester (RUHEMANN and STAPLETON), T., 1183; P., 1900, 168.
- 3:5-Diphenyl-1:2:4-triazole**, preparation and isolation of (SILBERRAD), T., 1188; P., 1900, 169.
- Diphthalic acid** (GRAEBE and HÖNIGSBERGER), A., i, 506.
- Diphtheritic paralysis** and antitoxin (RAINY; RANSOM), A., ii, 557.
- Dipiperonaldiphenylhydrotetrazone** and its isomeric transformations (MINUNNI), A., i, 259.
- Diisopropyl**. See Hexane.
- Diisopropyl diketone** (PONZIO), A., i, 588.
- Di-*p*-isopropylhippuroflavin**. See Cuminuroflavin.
- Dipropylhydroxylamine**, reactions of (MAMLOCK and WOLFFENSTEIN), A., i, 209.
- β -Dipropylhydroxylamine** and its salts (BEWAD), A., i, 630.
- s*-Di-*n*- and -*iso*-propylsuccinic acids**, *cis*- and *trans*- (octanedicarboxylic acids), preparation and properties of (BONE and SPRANKLING), T., 654; P., 1900, 71.
- 5-Dipyrasyloethane** and its dicarboxylic acid and ester (GRAY), A., i, 376.
- Disease**, behaviour of bacteriological enzymes in (EMMERICH and LÖW), A., ii, 159.
- Dispersion**. See Photochemistry.
- Dissociation** and dissociation equilibrium of highly dissociated electrolytes (JAHN), A., ii, 522, 707.
- relation between taste and, of acid salts (KAHLENBERG), A., ii, 270, 646; (RICHARDS), A., ii, 391.
- in dilute solutions at 0° (WHETHAM), A., ii, 390.
- in colloidal solutions (LEVI), A., ii, 646.
- in isohydric solutions (BANCROFT), A., ii, 529.
- of hydrates in solution (BANCROFT), A., ii, 195.
- of dissolved substances (VANDENBERGHE), A., ii, 335.
- of alkyl haloids, nitrates, and sulphates (NEF), A., i, 4, 349.
- of ammonium and potassium mercuriodides by water (FRANÇOIS), A., ii, 142.
- of aromatic nitro-derivatives in formic acid (BRUNI and BERTI), A., ii, 591.
- electrolytic. See Electrochemistry.
- molecular, of ammonia and of amines in aqueous solution (HANTZSCH and SEBALDT), A., ii, 69.
- Dissociation constants** of alkyl-substituted succinic acids (BONE and SPRANKLING), T., 667, 1298; P., 1900, 72, 184.
- of normal saturated dibasic acids (WALKER), T., 397.
- of azimide (WEST), T., 705; P., 1900, 74.
- of campholytic and isolaunonic acids (WALKER), T., 399.
- of camphoric acid and its derivatives (WALKER), T., 396; P., 1900, 61.
- of carbon dioxide (WALKER and CORMACK), T., 8; P., 1899, 208.
- of dehydracetic acid (WALKER), T., 971; P., 1900, 147.
- of hydrochloric and the chloroacetic acids dissolved in mixtures of organic solvents and water (MORELLO), A., ii, 395.
- of hydrocyanic acid (WALKER and CORMACK), T., 15; P., 1899, 208.
- Dissolver**, a (HOPKINS), A., ii, 71.
- Distillation apparatus** (STREATFIELD and SOUTHERDEN), A., ii, 718.
- of water, apparatus for the (MAREK), A., ii, 202.
- Disulphones** (POSNER and FAHRENHORST), A., i, 16.
- reactivity of the hydrogen atoms in (KÜTZ), A., i, 369.
- of ketonic acids (POSNER), A., i, 5.
- $\text{CH}_3(\text{SO}_2\text{R})_2$, action of formaldehyde on (KÜTZ), A., i, 370.

Di-*p*-toluenesulpheno-methylpiperaside and -propylenediamine (ESCH and MARCKWALD), A., i, 336.

Di-*o*-, -*m*-, and -*p*-tolylethylenediamines, their nitro-derivatives, nitrates, and mercurichlorides (MILLS), T., 1020 ; P., 1900, 127.

Ditolyl ethylene diketone. See Succitoyl ketone.

Di-*o*- and -*p*-tolylguanidines, amino-, reactions of (BUSCH and BAUER), A., i, 415.

Di-*m*-tolylmethane, 2:2':4'- and 4:2':4'-tri-amino- (COHN and FISCHER), A., i, 690.

Di-*m*- and -*p*-tolylmethylenedihydroxylamine (BAMBERGER), A., i, 342.

Ditolylsuccinide (LIMPRICHT), A., i, 600.

Di-*o*- and -*p*-tolylisothiocarbamides, acyl derivatives (HUGERSHOFF), A., i, 156.

Ditrimethylenetetrasulphone
 $\text{CH}_2(\text{CH} \begin{smallmatrix} \text{SO}_2 \text{CH}_2 \\ \text{SO}_2 \text{CH}_2 \end{smallmatrix}) \text{CH}_2)_2$ (KÜTZ), A., i, 370.

Diuretics and its relation to the changes in the composition of blood after transfusion of sodium chloride (MAGNUS), A., ii, 665.

Dixenylamine, diamino- (diaminotetraphenylamine) (MERZ and STRASSER), A., i, 313.

***m*-Dixylylcarbamides, dinitro-**
 $[\text{NH}:\text{NO}_2 = 4:5 \text{ and } 4:6]$ (VITTENET), A., i, 158.

***m*-Dixylylene, $\text{C}_{18}\text{H}_{16}$** (PELLEGRIN), A., i, 151.

Di-*p*-xylyl-*o*-methylenedihydroxylamine (BAMBERGER), A., i, 342.

Dogs. See Agricultural Chemistry.

Dolerite from New Jersey (PHILLIPS), A., ii, 27.

Dolomite, phosphorescent, from Elba (D'ACHIARDI), A., ii, 661.

Dopplerite from Oldenburg (CLAESSEN), A., ii, 20.

Dressings, surgical, estimation of corrosive sublimate in (LEHMANN), A., ii, 443, 511; (UTZ), A., ii, 722.

estimation of iodoform in, volumetrically (LEHMANN), A., ii, 372, 767.

Drugs, new; aromatic hydroxy acids and esters (EINHORN), A., i, 439.

glucinyll derivatives of the esters of aromatic amino- and hydroxy-amino-acids (EINHORN and OPPENHEIMER), A., i, 493.

chemical behaviour of, in the organism (FRÄNKEL), A., ii, 423.

containing alkaloids, alkalimetric method for the valuation of (GORDIN), A., ii, 777.

Dulcitol in the bark of *Euonymus alatus* (HOEHNEL), A., ii, 427.

Duryluric acid. See 2:4:5-Trimethylhippuric acid.

Dypnone, distillation of (AMEYE), A., i, 35; action of potassium hydroxide on (GESCHÉ), A., i, 604.

action of zinc ethyl and of heat on (DELACRE), A., i, 603.

Dypnopinalcolene (DELACRE), A., i, 603.

E.

Earth, edible, from Fiji (CORNEY, DAVID, and GUTHRIE), A., ii, 569.

Earths, rare, new spectra of the (DEMARÇAY), A., ii, 656.

luminescence spectra of the (MUTHMANN and BAUER), A., ii, 544.

molecular susceptibility of salts of the (MEYER), A., ii, 7, 186; (DU BOIS and LIEBKNECHT), A., ii, 127, 333.

new method of fractionating some (DEMARÇAY), A., ii, 347.

separation of the (MUTHMANN and BÖHM), A., ii, 209; (URBAIN; CHAVASTELON), A., ii, 346.

See also Cerite metals.

Egonines, *d*- and *l*-, oxidation of (WILLSTÄTTER and BODE), A., i, 245.

Echinopsine and its salts (GRESHOFF), A., i, 556.

Edestin, metabolism with (LEIPZIGER), A., ii, 223.

basic decomposition products of (LEVEENE), A., i, 318.

Effusion, phenomena of, of permanent gases (EMDEN), A., ii, 10.

relative rates of, of argon, helium, and other gases (DONNAN), A., ii, 390.

Effusions, milky serous (SHAW), A., ii, 229.

Egg-albumin. See Albumin.

Eggs, echinoid, chemical fertilisation of (LOEB), A., ii, 555, 608; (VIGNIER), A., ii, 608.

hens', composition of (JUCKENACK), A., ii, 290.

diastatic ferment in (MÜLLER and MASUYAMA), A., ii, 420.

chemical changes in the developing (LEVEENE), A., ii, 290.

Egg-white, proteids of (OSBORNE and CAMPBELL), A., i, 574.

Egg-yolk, proteids of (OSBORNE and CAMPBELL), A., i, 616.

detection of, in margarine (MECKE), A., ii, 123.

Ehlite. See Phosphorocalcite.

Ehrlich's diazo-reaction (BRIEGER), A., i, 316; (CLEMENS), A., ii, 227; (WESENBERG), A., ii, 776.
 for the recognition of some morphine derivatives (CARCANO), A., ii, 776.

Elaidic acid, formation of, and action of dilute nitric acid on (EDMED), P., 1899, 190.

Elastin, proportion of basic nitrogen in (EUSTIS), A., i, 317.

ELECTROCHEMISTRY :—
Electrochemistry, quantitative lecture experiments on (MILLER and KENRICK), A., ii, 703.

Accumulators, lead, theory of (DOLEZALEK), A., ii, 2; (MUGDAN), A., ii, 463.
 gaseous polarisation in (NERNST and DOLEZALEK), A., ii, 641; (STRASSER and GAHL), A., ii, 642.

Cell, aluminium (NORDEN), A., ii, 404; (MORGAN and DUFF), A., ii, 588.
 new electrolytic, for rectifying alternating currents (HILDBURGH), A., ii, 520.
 chromium, for the rectification of alternating currents (MORGAN and DUFF), A., ii, 588.

Clark, thermodynamics of (COHEN), A., ii, 520, 703.
 inversion of hexa- and heptahydrates of zinc sulphate in the (BARNES), A., ii, 254.
 concentration, with unalterable electrodes (SCHAUM), A., ii, 2.
 gas, theory of (BOSE), A., ii, 704.
 grey tin | solution of a tin salt | white tin (COHEN), A., ii, 183.
 transition, of the third kind, theory of (COHEN), A., ii, 184.
 voltaic, reversibility of (MOORE), A., ii, 381.

Weston (COHEN), A., ii, 702, 703; (JAEGER and LINDECK), A., ii, 703.
 as a transition cell, and its ratio to a Clark cell (BARNES), A., ii, 520.

Conductivity, conditions under which substances possess (ABEGG), A., ii, 5.
 determination of, with direct current instruments (MORGAN and HILDBURGH), A., ii, 521.
 in gases traversed by cathode rays (MCLENNAN), A., ii, 587.
 and internal friction in saline solutions (MASSOULIER), A., ii, 331.

ELECTROCHEMISTRY :—

Conductivity, specific gravity and surface tension of aqueous solutions containing potassium chloride and sulphate (BARNES), A., ii, 332.
 of acids, apparatus for measuring the (WALKER and CORMACK), T., 5; P., 1899, 208.
 of saturated fatty acids (BILLITZER), A., i, 7.
 of alkali chlorides and nitrates (KOHLEBAUSCH and MALTBY), A., ii, 61.
 of dilute amalgams, influence of temperature on (LARSEN), A., ii, 255.
 of liquid ammonia solutions (FRANKLIN and KRAUS), A., ii, 382.
 of a solution of ammonia, change of the, on the addition of salts (KONOWALOFF), A., ii, 266.
 of azoimide (WEST), T., 707; P., 1900, 74.
 of benzoic acid, influence of substituents on the (TINGLE), A., ii, 6.
 of caesium (ECKARDT and GRAEFFE), A., ii, 479.
 of aqueous solutions of hydrochloric and sulphuric acids (BARNES), A., ii, 522.
 of the sodium salts of hydroxymethane-, hydroxyethane-, and hydroxypentane-sulphonic acids (COJAZZI), A., i, 327.
 of some sodium derivatives of nitro-paraffins (SULC), A., ii, 332.
 of platinum tetrachloride solutions (MIOLATI), A., ii, 214.
 of compressed powders (STREINTZ), A., ii, 641.
 of saturated solutions (DAWSON and WILLIAMS), A., ii, 383.
 of non-aqueous solutions of inorganic salts (LINCOLN), A., ii, 6.
 of double thiocyanates and cyanides (WALDEN), A., i, 430.
 of animal juices and tissues (OKER-BLOM), A., ii, 290, 356, 607.

Current density, relation between polarisation and, in solid and fused salts (GOCKEL), A., ii, 704.

Current, metallic crystallisation by the (TOMMASINA), A., ii, 185; (TOMMASI), A., ii, 339.
 constant, action of, on the respiration of "surviving" muscle (GUILLLOZ), A., ii, 221.

Contact breaker, new (MORGAN), A., ii, 255.

ELECTROCHEMISTRY :—

- Dielectric constant**, method of determining (COOLIDGE), A., ii, 3.
 of hydrogen peroxide (CALVERT), A., ii, 331.
- Electrocapillary phenomena**, nature of (SMITH), A., ii, 330.
- Electromagnetic theory**, validity of Maxwell's equations relating to (WEDELL-WEDELLSBORG; SCHEYE), A., ii, 254.
 refutation of Poynting's theorem relating to (WEDELL-WEDELLSBORG), A., ii, 519.
 an application of Poynting's theorem (MIE), A., ii, 703.
- Electrification of electrolytic gases** (KÖSTERS), A., ii, 4.
- Electric charge of the deviable rays of radium** (P. and S. CURIE), A., ii, 254.
- Electric discharge**, silent, chemical effects of the, compared with the chemical action of light (BEETHLOT), A., ii, 329.
 in nitrogen, fluorescence and after-glow accompanying an (LEWIS), A., ii, 702.
- Electrical effects** due to the evaporation of sodium in air and other gases (HENDERSON), A., ii, 588.
- Electrical resistance**, method of determining (COHEN), A., ii, 188.
 change of, of lead dioxide (SUNDORFF), A., ii, 5.
 of tellurium (LENHER and MORGAN), A., ii, 273.
- Electric oscillations**, transparency of liquids to (DE HEEN), A., ii, 524.
- Electrical properties of metals**, influence of light on the (BUISSON), A., ii, 519.
- Thermo-electrical properties of alloys** (STEINMANN), A., ii, 523, 524.
- Electrical waves** (COOLIDGE), A., ii, 3.
- Electrochemical equivalent of carbon** (PEASE), A., ii, 257; (SKINNER), A., ii, 523.
 of copper and silver (RICHARDS, COLLINS, and HEIMROD), A., ii, 256.
- Electrochemical properties of silver fluoride and of fluorine** (ABEGG and IMMERWAHR), A., ii, 256.
- Electrode**, metallic deposition by electrical transport from one, to the other (TOMMASINA), A., ii, 185.
- Electrodes**, new, for electrolytic estimations (HOLLARD), A., ii, 435.
 reversible, of the second order, potential of, with mixed depolarisers (THIEL), A., ii, 521.

VOL. LXXVIII. ii.

ELECTROCHEMISTRY :—

- Electrolysis**, experiments on (CASPARI), A., ii, 7.
 accessory reactions in (BROCHET), A., ii, 706.
- Ostet's gasometric method for (BROCHET), A., ii, 706.
- through semipermeable membranes (MORITZ), A., ii, 522.
- of fused salts (LORENZ and HELENFENSTEIN), A., ii, 333; (HELENFENSTEIN), A., ii, 333; (QUINCKE; LORENZ), A., ii, 644.
- of alkali chloride solutions (FOERSTER), A., ii, 72, 400; (MÜLLER), A., ii, 73; (BROCHET), A., ii, 205, 276, 541; (WOHLWILL), A., ii, 400, 471; (SIEVERTS), A., ii, 470; (LORENZ and WEHLIN), A., ii, 476.
- of alkali chloride solutions with a diaphragm (FOERSTER and JORRE), A., ii, 343.
- of alkali chloride solutions, evolution of oxygen at the anode in the (FOERSTER and SONNEBORN), A., ii, 645.
- of the bromides of the alkaline earth metals (SARGHEL), A., ii, 400.
- of concentrated hypochlorite solutions (BROCHET), A., ii, 594, 706.
- of lithium chloride (KAHLENBERG), A., ii, 206.
- of potassium chlorate (VOEGE), A., ii, 185.
- of potassium chloride (BROCHET), A., ii, 205, 276, 541.
- of sodium chloride (WOLF), A., ii, 332; (LORENZ and WEHLIN), A., ii, 476.
- of the nitrogen hydrides and of hydroxylamine (SZARVASY), T., 603; P., 1900, 3.
- of azoimide (PERATONER and ODDO), A., ii, 651.
- of metallic phosphate solutions (FERNBERGER and SMITH), A., ii, 109.
- of sulphuric acid, nature of the process which occurs at the aluminium anode in the (NORDEN), A., ii, 404; (MORGAN and DUFF), A., ii, 589.
- of zinc and manganese (RIEDERER), A., ii, 49.
- of the alkali salts of organic acids (PETERSEN), A., ii, 522.
- of silver acetate (MULDER), A., ii, 724.
- of fused mixtures of aniline and its hydrochloride (SZARVASY), T., 208; P., 1899, 194.

65

ELECTROCHEMISTRY :—

- Electrolysis** of aniline and nitrobenzene (MÖLLER, A., i, 27.
- of azo- and of nitrobenzene (LÖB, A., i, 697 ; ii, 706.
- of ethyl potassium diethoxysuccinate (BROWN and BOLAM, A., i, 201.
- of solutions of sucrose (ULSCH, A., i, 15.
- Electrolytes**, coagulative power of (WHETHAM, A., ii, 62.
- relation between heat of solution and solubility of (VAN LAAR, A., ii, 708.
- depression of the freezing point by mixtures of (BARNES), A., ii, 526.
- highly dissociated, degree of dissociation and dissociation equilibrium of (JAHN), A., ii, 522, 707.
- finding the composition of mixed, when the degree of dissociation is given (MACGREGOR, A., ii, 332.
- Non-electrolytes**, freezing point of aqueous solutions of (LOOMIS, A., ii, 335.
- Electrolytic dissociation** of acids and bases and heat of neutralisation (THIEL, A., ii, 260.
- of very weak inorganic acids (WALKER and CORMACK, T., 5 ; P., 1899, 208.
- of aqueous solutions of two electrolytes with one common ion (MACGREGOR, A., ii, 62.
- of certain salts in methyl and ethyl alcohols by the boiling point method (JONES, A., ii, 187.
- of solutions of potassium and sodium sulphates tested by freezing point determinations (ARCHIBALD, A., ii, 65.
- Electrolytic decomposition point** of aqueous solutions (GÖCKEL, A., ii, 332.
- Electrolytic deposition** of metals from non-aqueous solutions (KAHLENBERG), A., ii, 521.
- of brass (MORGAN, A., ii, 345.
- of chromium (COWPER-COLES), A., ii, 408.
- Electrolytic formation** of chlorates and hypochlorites (FOERSTER), A., ii, 72, 400 ; (MÜLLER, A., ii, 73 ; (BROCHET, A., ii, 205, 276, 541, 706 ; (FOERSTER and JORKE), A., ii, 343 ; (WOLF, A., ii, 382 ; (WOHLWILL), A., ii, 400, 471 ; (SIEVERTS), A., ii, 470 ; (LORENZ and WEHRLIN), A., ii, 476 ; (FOERSTER and SONNEBORN), A., ii, 645.

ELECTROCHEMISTRY :—

- Electrolytic preparation** of benzidine (LÖB, A., i, 697 ; ii, 706.
- of induline dyes (SZARVASY), T., 207 ; P., 1899, 194.
- of colouring matters resembling indulines (LÖB, A., i, 464.
- Electrolytic modification** of Sandmeyer's and Gattermann's reactions (VOTOČEK and ZENFSEK), A., i, 19.
- Electrolytic oxidation** of ketoximes (SCHMIDT, A., i, 332.
- of succinic acid (CLARKE and SMITH), A., i, 77.
- Electrolytic reduction** (LÖB, A., ii, 706.
- of difficultly reducible substances in sulphuric acid solution (TAFEL), A., ii, 588.
- of nitrobenzene (HABER, A., i, 281 ; ii, 257 ; (HABER and SCHMIDT), A., ii, 282.
- of *p*-nitroacetanilide (SONNEBORN), A., i, 464.
- of *m*-nitrotoluene (ROHDE), A., i, 20.
- of succinimides (TAFEL and STERN), A., i, 557.
- Electrolytic synthesis** of iodoform (DONY-HÉNAULT), A., i, 577.
- of ketones and diketones (HOFER), A., i, 275.
- of organic substances (DONY-HÉNAULT), A., ii, 644.
- Electrolytic solution pressure**, theory of (LEHFELDT, A., ii, 62 ; (KRÜGER ; NEHNST), A., ii, 706.
- Electromotive behaviour** of substances with several stages of oxidation (LUTHER), A., ii, 705.
- of chromium (HITTOFF), A., ii, 127 ; (MORGAN and DUFF), A., ii, 589.
- Electromotive efficiency** of the elementary gases (BOSE), A., ii, 704.
- Electromotive force** and chemical equilibrium (ROTHMUND), A., ii, 183 ; (DANNEEL), A., ii, 464.
- and diffusion velocity, influence of the addition of a salt with one similar ion on (ABEGG and BOSE), A., ii, 127.
- of cells containing red and yellow mercuric oxides (COHEN), A., ii, 184.
- of the Clark cell, change of (BARNES), A., ii, 254.
- of fused halogen compounds of heavy metals (LORENZ), A., ii, 61.
- Ions**, velocity of, produced in gases by Röntgen rays (ZELENY), A., ii, 587.
- migration and separation of, apparatus for illustrating the (MÜLLER), A., ii, 643.

ELECTROCHEMISTRY:—

- Migration constant** of sulphuric acid (KENDRICK), A., ii, 643.
- Ionic charges**, effect of the interaction of, on osmotic pressure (v. TÜBIN), A., ii, 712.
- Ionic mobility**, model to show (KOHLEKAUSCH), A., ii, 712.
- Ionisation** of complex solutions of given concentration, finding the, and the converse problem (MACGREGOR), A., ii, 332.
- Ion concentrations** in solutions of potassium, sodium, and hydrogen chlorides (JAHN), A., ii, 522, 707. in fused salts (LORENZ), A., ii, 61.
- Polarisation**, relation between current density and, in solid and fused salts (GOCKEL), A., ii, 704. in quantitative electrolytic determinations (MARSHALL), A., ii, 185. gaseous, in the lead accumulator (NERNST and DOLEZALEK), A., ii, 641; (STRASSER and GAHL), A., ii, 642.
- Potential** of reversible electrodes of the second order with mixed depolarisers (THIEL), A., ii, 521. discharge, of chlorine ions (MÜLLEK), A., ii, 643.
- Potentials**, oxidation (CROTOGINO), A., ii, 642. of copper electrodes in solutions (IMMERWAHR), A., ii, 642.
- Potential difference** with manganese dioxide electrodes (TOWER), A., ii, 331. between solutions in relation to electrocapillary phenomena (SMITH), A., ii, 330. between a platinum and an iodine electrode (KÜSTER and CROTOGINO), A., ii, 255. between a solid salt and its solution (CAMPETTI), A., ii, 704. of silver in solutions of its mixed halogen salts (KÜSTER and THIEL), A., ii, 255.
- Element**, new, in crude samarium oxide (DEMARÇAY), A., ii, 481.
- Elements**, etymological researches on the names of the (DIERGAART), A., ii, 59. relation of physical properties of, to atomic weights (SANDER), A., ii, 137; (BAYLEY), A., ii, 188. hardness of the (RYDBERG), A., ii, 392. estimation of, in organic compounds (BERTHELOT), A., ii, 172.
- Ellagic acid** from various tannin matters (PERKIN), T., 423.

- Elm galls**, gum in (PASSERINI), A., ii, 427.
- Embelic acid** and its dibenzoyl derivative (HEFFTER and FEUERSTEIN), A., i, 496.
- Emodin** and its constitution (HESSE), A., i, 40; (LIEBERMANN), A., i, 355. aloe- and frangula-, distinction between (OESTERLE), A., i, 304.
- Emulsin** in tobacco leaves (BEHRENS), A., ii, 239.
- Enantiotropy** of tin (COHEN and VAN EIJK), A., ii, 83, 212; (COHEN), A., ii, 212, 408.
- Endiolite** from Greenland (FLINK), A., ii, 412.
- Endlichite** from Hillsboro', New Mexico (GOLDSCHMIDT), A., ii, 600.
- Energy**, free, development and application of a general equation for (LEWIS), A., ii, 264. change of, in fused halogen compounds of heavy metals (LORENZ), A., ii, 61.
- Enzymes** (SACHAROFF), A., i, 268. action of, in resolving racemic compounds (FISCHEK), A., i, 140; (MARCKWALD and MCKENZIE), A., i, 207. effect of, on the germination of old seed (THOMSON), A., ii, 496. ammonia-forming, in the liver (JACOBY), A., ii, 672. amylolytic and proteolytic, in human faeces (HEMMETER), A., ii, 607. bacteriological, behaviour of, in disease (EMMERICH and LÖW), A., ii, 159. cellulose (NEWCOMBE), A., ii, 99. diastatic, in hens' eggs (MÜLLER and MASUYAMA), A., ii, 420. distribution of, in the potato plant and in oats (MAYER), A., ii, 427. indigo (BEYERINCK), A., i, 230, 403; (HAZEWINKEL), A., i, 403. inorganic (BREDIG and MÜLLER v. BERNECK), A., ii, 213. lipolytic, in human ascitic fluid (HAMBURGER), A., ii, 420. oxidising, decomposition of chlorophyll by (WOODS), A., ii, 234. in the vine (CORNU), A., ii, 102. oxidising and reducing, in the animal organism (ABELOUS and GÉRARD), A., i, 268. hydrogenating and reducing, in the organism (ABELOUS and GÉRARD), A., ii, 226. proteolytic, produced by *Aspergillus niger* (MALFITANO), A., ii, 493.

Enzymes, proteolytic, of malt (FERNBACH and HUBERT), A., i, 576, 616; (WINDISCH and SCHELLHORN), A., i, 712.
 occurrence and action of, in germinated seeds (BUTKEWITSCH), A., ii, 744.
 of germinating seeds (HARLAY), A., ii, 744.
 produced during the germination of seeds (BOURQUELOT and HÉRISSEY), A., ii, 35, 233.
 of the carob bean (BOURQUELOT and HÉRISSEY), A., i, 320; ii, 35, 233.
 of "koji" (KOZAI), A., ii, 743.
 formation of, characteristic, of yeasts (KLÖCKER), A., ii, 743.

Enzymes. See also :—

Aldehydase.
 Amylase.
 Chymosin.
 Diastase.
 Emulsin.
 Galactase.
 Gauthierase.
 Invertase.
 Isatase.
 Lactase.
 Pancreatin.
 Papain.
 Parachymosin.
 Pepsin.
 Rhamniase.
 Schinoxidase.
 Seminase.
 Trypsin.
 Tyrosinase.
 Zymase.

Epichlorhydrin, action of potassium hydroxide on, in presence of alcohols (ZUNINO), A., i, 535.

Epidote (TERMIER), A., ii, 785.

Epinephrine, its salts, and triacetyl and benzoyl derivatives (ABEL), A., i, 72.
 phenylcarbamic ester of (ABEL), A., i, 368.

Epistolite from Greenland (BOEGILD), A., ii, 414.

Equation of condition. (REINGANUM), A., ii, 135.

for liquids; determination of the constants α and β of van der Waal's equation (GUYE and FRIDERICH), A., ii, 709.

EQUILIBRIUM :—

Phase rule, Gibbs' (WIND), A., ii, 197.
 application of, to alloys and rocks (LE CHATELIER), A., ii, 197.

Equilibrium, development and application of a general equation for physico-chemical (LEWIS), A., ii, 264.

EQUILIBRIUM :—

Equilibrium in isomorphous mixtures (BRUNI and GORNI), A., ii, 197.

in the system, acetone, water, phenol (SCHREINEMAKERS), A., ii, 393.

between alcohol, gelatin, and water; and agar and water (HARDY), A., ii, 396.

in systems containing an alkali salt, water, and alcohol (DE BRUYN), A., ii, 266.

in the system, aniline, water, phenol (SCHREINEMAKERS), A., ii, 135.

between hydrochloric acid, phenol, and water (KRUG and CAMERON), A., ii, 393.

between hydrogen peroxide and persulphuric acid (LOWRY and WEST), T., 955; P., 1900, 127.

between lead and zinc, and mixtures of their fused chlorides (REINDERS), A., ii, 715.

in the systems, phenol, water, *d*-tartaric or racemic acid (SCHREINEMAKERS), A., ii, 393.

of the system, potassium sodium sulphate, sodium chloride, sodium sulphate (MEYERHOFFER and SAUNDERS), A., ii, 198.

between sulphuric acid and sulphates in aqueous solution (KAY), A., ii, 198.

Equilibrium phenomena in presence of a double salt (MEYERHOFFER and SAUNDERS), A., ii, 198.

Equilibrium relations of carnallite (VAN'T HOFF and MEYERHOFFER), A., ii, 12.

chemical. See Affinity.

false (BODENSTEIN), A., ii, 136.

Erbium, specific gravity of (MEYER), A., ii, 143.

didymium and yttrium, microchemical researches on (POZZI-ESCOIT and COQUET), A., ii, 404.

Erbium salts, effect of dilution, temperature, etc., on the absorption spectra of solutions of (LIVEING), A., ii, 517.

Erythritol in *Trentepohlia Jolithus* (BAMBERGER and LANDSIEDL), A., i, 579.

oxidation of, by the sorbose bacterium (BERTRAM), A., i, 377.

d-**Erythritol**, preparation of (BERTRAND), A., i, 424.

l-**Erythritol**, partial synthesis of (MAQUENNE), A., i, 423, 472.

l-**Erythronic acid** (*trihydroxybutyric acid*) (RUFF and MEUSSEK), A., i, 139.

d-Erythrose (RUFF and MEUSSER), A., i, 139.

l-Erythrose (MAQUENNE), A., i, 424, 472.

osazone and diacetamide (WOHL), A., i, 140.

l-Erythroseacetamide (MAQUENNE), A., i, 424, 472.

Erythrulose, a new sugar (BERTRAND), A., i, 377.

reduction of (BERTRAND), A., i, 424.

Essence of lemon and of bitter orange, analysis of (WENDER and GREGOR), A., ii, 767.

Esterification of the alcohol, $C_6H_{10}O$, from isoprene bromide (MOKIEWSKY and MENSCHUTKIN), A., i, 509.

of camphoric acid (WEGSCHEIDER), A., i, 10.

of cinchomeric and quinolinic acids (KIRPAL), A., i, 51.

of phosphoric acid by glycerol, velocity and limits of the (IMBERT and BELUGOU), A., i, 130.

of the phthalic acid group (GRAEBE), A., i, 547.

of bromo- and hydroxy-terephthalic acids (WEGSCHEIDER and BITTNER), A., i, 658.

of nitroterephthalic acid (WEGSCHEIDER), A., i, 657.

Esters, rate of formation of, from benzoyl chloride and fatty alcohols (BRUNER and TOLLOZKO), A., ii, 648.

decomposition of (ŠULC), A., ii, 395.

double compounds of, with orthophosphoric acid (RAIKOW), A., i, 602.

of ketonic acids, influence of the solvent on the constitution of (WISLICHENUS), A., i, 9.

β -ketonic, condensation of, with amines (TINGLE), A., i, 544.

Ethane, preparation of (SABATIER and SENDERENS), A., i, 469, 470, 471, 534.

bromine derivatives (POURET), A., i, 369.

compounds of, with aluminium bromide and carbon disulphide (KONOWALOFF and PLOTNIKOFF), A., i, 323.

Ethane, *as*-dichloro- (*ethylidene chloride*), action of, on phenols (FOSSE and EITTLINGER), A., i, 392.

Ethanedicarboxylic acids. See :—
Methylmalonic acid.
Succinic acid.

Ethanomercury salts (HOFMANN and SAND), A., i, 385, 618; (BILLMANN), A., i, 432.

Ethenemercury salts (HOFMANN and SAND), A., i, 384.

Ethenyltriaminonaphthalene and its isomeride and their salts, and acyl-, methyl-, and phenylazo-derivatives (MELDOLA and EYNON), T., 1159; P., 1900, 166.

Ether. See Ethyl ether.

Ether, $C_{12}H_{20}O_3$ from ethyl alcohol, isoamyl nitrite and hydrogen chloride (KISSEL), A., i, 620.

Etherification, inhibiting effect of, on substitution in phenols (ARMSTRONG and LEWIS), P., 1900, 157.

of β -naphthol derivatives (DAVIS), T., 33; P., 1899, 210.

Ethers, formation of, by means of dry silver oxide and alkyl haloids (LANDER), T., 729; P., 1900, 6, 90.
decomposition of, by heat (TISTSCHENKO), A., i, 271.

Ethers. See also :—

Acetal-cresol.

Acetal-resorcinol.

p-Acetoxy- ψ -cumyl dibromo-*p*- ψ -cumyl ether.

p-Acetoxymesityl ethers.

Anethole.

Anisole.

Benzeneazo-*o*-dibromophenol ethyl ether.

p-Benzoxymesityl ethyl ether.

Benzylidenebisresacetophenone ethyl ether.

p-isoButyroxoy- ψ -cumyl ethyl ether.

p-isoButyroxymesityl ethyl ether.

Carvacrylacetal.

Cedron methyl ether.

Cinnamylgualacol.

Citronellaldimethylacetal.

ψ -Cumenoxypropionacetal.

isoDialdane.

Dibenzylformal.

3:5-Dihydroxyanisole.

Dihydroxydimesityl ether.

1:4-Dimethoxynaphthalene.

Dimethoxyphenanthrenes.

3:4-Dimethoxystilbene.

Dinaphthoxyethane.

Diphenoxyethane.

Diphenylmethyl oxide.

Diphenylphenol methyl ether.

Ethoxyhydrindene.

Ethyl allyl ethers.

Ethyl ether.

o-Ethylphenoxyacetal.

Eugenyl propyl ethers.

Fisetol ethyl ether.

Gallein ethyl ethers.

Gallin ethers.

Glyceryl diisopropyl, *tert*.-butyl, di-capryl, dioctyl, and dibenzyl ethers.

Ethers. See:—

- Guaiacol.
p-Hydroxybenzyl alcohol, ethers of.
 Hydroxy- ψ -cumyl ethers.
 Hydroxy- ψ -cumylene ethers.
 1:4-Hydroxyethoxynaphthalene.
 4-Hydroxymesityl ethers.
 1:4-Hydroxymethoxynaphthalene.
 3:4-Hydroxymethoxyphenanthrene.
 β -Hydroxypropaldehydiethylacetal.
 Hydroxyxylylene glycols, ethers of.
 Indoneresorcinol ether.
 Ketoapocinchénine ethyl ether.
 Ketoapohomocinchénine ethyl ether.
 Luteolin ethers.
o-Methoxybenzyl alcohol, methyl and ethyl ethers of.
 Methoxybenzylidenecamphor.
 5-Methoxyhydrindene.
 Methoxymesityl oxide.
 Methoxyphenanthrenes.
o-Methoxyphenoxystyrene.
p-Methoxystilbene.
o-Methoxystyrene.
 Methylacetalylquinol.
 Methylacetalylresorcinol.
 Methylal.
 β -Naphthyl methyl, ethyl, and propyl ethers.
 Orcinol methyl ether.
 Phenol ethers.
 α -Phenoxypropionacetal.
 Phenoxystyrene.
 Phentetrol ethyl ether.
 Phenyl benzyl ethers.
 Phloroglucinol ethers.
p-*iso*Propylphenoxycetal.
 Quinolinephenetole.
 Resorcinol methyl ethers.
 Safrole.
 Thymoxycetal.
 Tolyloxypionacetal.
 Tolyloxystyrenes.
 1:5:6-Trimethoxyphenanthrene.
 Trimethyldihydroresorcinol ethyl ether.
 Triphenylcarbinol ethers.
 Vanillin methyl ether.
 Xylenol ethers.
 Xylenoxycetal.
- β -Ethothio-isocrotonic, α -methyl-, and α -ethyl-isocrotonic acids (POSNER), A., i, 5.
 β -Ethothio-glutaconic acid and its salts (POSNER), A., i, 6.
 α -Ethoxy- γ -amyloxyisovaleric acid (KISSEL), A., i, 620.
p-Ethoxybenzonitrile (HENRY), A., i, 172.
 β -Ethoxy- β -benzylacrylic acid, α -cyano-, methyl ester (HALLER and BLANC), A., i, 496.
- Ethoxycaronic acid and anhydride** (PERKIN, THORPE, and WALKER), P., 1900, 149.
3-Ethoxy-1:5-diphenyltriazole (WHEELER and JOHNSON), A., i, 634.
6-Ethoxyflavanoneoxime (v. KOSTANECKI), A., i, 449.
4'-Ethoxyflavone (GROSSMANN and v. KOSTANECKI), A., i, 669.
Ethoxyformamidine. See Ethylisuretine.
p-Ethoxyformanilide (BÉHAL), A., i, 581.
5-Ethoxyhydrindene (MOSCHNER), A., i, 344.
7-Ethoxy-2-methylchromone (BLOCH and v. KOSTANECKI), A., i, 308.
2-Ethoxy-3:4-methylenedioxy-flavanone and -flavone (v. KOSTANECKI and SCHMIDT), A., i, 238.
4-Ethoxy-2-methyltrimesic acid and its esters (ERRERA), A., i, 33.
 β -Ethoxy- β -phenylacrylic acid, α -cyano-, ethyl ester (HALLER and BLANC), A., i, 496.
3-Ethoxy-1-phenyl-3-methyltriazole (WHEELER and JOHNSON), A., i, 634.
Ethoxyphenylthiodiazolone (WHEELER and BARNES), A., i, 564.
3-Ethoxy-1-phenyl-5-triazolone (WHEELER and SANDERS), A., i, 564.
p-Ethoxyphenylurethane, sulphonic acid of (COHN), A., i, 29.
2-Ethoxypyridine, 3:5:6:4-trichloro-amino- (SELL and DOOTSON), T., 4.
Ethylacetooacetic acid, ethyl ester, action of dry silver oxide and ethyl iodide on (LANDER), T., 741; P., 1900, 6.
Ethyl alcohol, formation of, in the putrefaction of proteids free from carbohydrates (VITALI), A., ii, 297.
 boiling point of, with mixtures of methyl alcohol (HAYWOOD), A., ii, 64.
 action of, on proteids (ROSEMAN), A., ii, 92, 356.
 action of sodium platinichloride on (JÖRGENSEN), A., i, 542.
 influence of, on milk formation (ROSEMAN), A., ii, 225.
 effect of ingested, during pregnancy (NICLOUX), A., ii, 416.
 influence of, on muscular work (SCHEFFER), A., ii, 418.
 nutritive value of (ATWATER), A., ii, 288.
 denatured, detection of benzene in (HALPHEN), A., ii, 446.
 estimation of, in the blood and tissues in acute alcoholism (GRÉHANT), A., ii, 95, 112.
 estimation of, in lemonade essences (WENDER and GREGOR), A., ii, 767.

- Ethyl allyl ethers**, substituted, action of nitrosyl chloride on (IPATIEFF), A., i, 15.
cyanide. See Propionitrile.
- diphenyl- and ditolyl-ethenylamidine-carbonates** and their acetyl derivatives (TRAUBE and EYME), A., i, 118.
- Ethyl ether**, refractive power of, near the critical point (GALITZIN and WILIP), A., ii, 461.
boiling point of, with mixtures of benzene and methyl alcohol (HAYWOOD), A., ii, 64.
behaviour of, under the influence of light and oxygen (BERTHELOT), A., i, 3.
action of, on alkaloid salts (SCHAER), A., ii, 455.
detection of acetaldehyde in (BLASER), A., ii, 179.
- Ethyl ether mercury bromide** (HOFMANN and SAND), A., i, 618.
mercury chloride (HOFMANN and SAND), A., i, 385.
- Ethyl iodide**, action of, on mercurous nitrite (RAY), P., 1899, 239.
mercaptan, action of, on acetylacetone, benzil, and benzoin (LLAGUET), A., i, 508.
condensation of, with ketonic acids (POSNER), A., i, 5.
nitrite, action of, on trisubstituted phenols (THIELE and EICHWEDE), A., i, 501.
- Ethylamine**, compounds of, with lithium chloride (BONNEFOI), A., ii, 130.
tellurium bromide and chloride (LENHER), A., i, 379.
tin haloids (COOK), A., i, 142.
- Ethylamino-bromo- and -chloro-indone** (LANSER and WIEDERMANN), A., i, 667.
- γ -Ethyl- β -amylene**. See Heptylene.
- β -Ethyl-sec- and -tert.-amylhydroxylamines** and their salts (BEWAD), A., i, 631.
- Ethylbenzene (phenylethane)** and its nitro- and amino-derivatives (WEISWEILLER), A., i, 291.
refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.
- β -Ethyl-sec.-butylhydroxylamine** and its salts (BEWAD), A., i, 630.
- Ethylisocarbamide** (STIEGLITZ and MCKEE), A., i, 431.
- 3-Ethylisocarbostyryl** (GABRIEL and COLMAN), A., i, 359.
- Ethylidichloroamine**, preparation of (PALOMAA; TCHERNIAO), A., i, 143.
- Ethylchlorophenomerpholone** (BISCHOFF), A., i, 442.
- Ethylchloroisopropylketoxime** (IPATIEFF), A., i, 14.
- Ethylcoumarones**, 4- and 6- (STOERMER), A., i, 652.
- Ethyleyanocaniline** (SCHOLL and NÖRR), A., i, 435.
- Ethyleytisine** (RAUWERDA), A., i, 608, 684.
- Ethylidiacetylacetone(?)** (COLLIE and STEELE), T., 970; P., 1900, 146.
- Ethylene**, preparation of (SABATIER and SENDERENS), A., i, 471, 534.
hydrogenation of, in presence of reduced metals (SABATIER and SENDERENS), A., i, 469.
hydrogenation of, in presence of finely divided platinum (SABATIER and SENDERENS), A., i, 471.
action of finely divided platinum, cobalt, and iron on (SABATIER and SENDERENS), A., i, 534.
action of, on mercury salts (HOFMANN and SAND), A., i, 384, 618; (BILLMANN), A., i, 431.
compounds of, with mercuric salts (HOFMANN and SAND), A., i, 618.
estimation of, in coal gas (HABER), A., ii, 629.
- Ethylene, dibromo-**, action of alcoholic potash on (NEF), A., i, 23.
perbromo-, action of metals on, and oxidation of (NEF), A., i, 23.
diiododinitro- and **triiodonitro-** (**triiodovinyl nitrate**) (BILTZ and KEDERSDY), A., i, 534.
- Ethylenebis-mono- and -di-phenylsemicarbazide**; **Ethylenebisphenylcarbazinic acid**, esters of, and **Ethylenebisphenylpicarazide** (HISCHMANN), A., i, 251.
- Ethylene-blue**, acyl derivatives of (COHN), A., i, 455.
- Ethylenediamine**, condensation of, with ethyl cetipate (THOMAS-MAMERT and WEIL), A., i, 459.
- Ethylene-diamine- and -diammonium-palladio-chlorides** (KURNAKOFF and GWOSDAREFF), A., i, 209.
- Ethylenedicarboxylic acid**. See Fumaric acid.
- Ethylene glycol diformate** (BEHAL), A., i, 581.
iodohydrin (CHARON and PAIX-SEAILLES), A., i, 423.
- Ethyleneketotriazolecarboxylic acid**, $\alpha\beta$ -dichloro-, and **tetrachloro-** (ZINCKE, STOFFEL, and PETERMANN), A., i, 527.
- Ethylene-1:2:3-triazolecarboxylic acid**, $\alpha\beta$ -dichloro-, and the action of chlorine on (ZINCKE, STOFFEL, and PETERMANN), A., i, 527.

- Ethylenetrimethylenediamine** carbamide, diphenylidithiocarbamide and thiocarbamate (ESCH and MARCKWALD), A., i, 836.
- β -Ethylsec. heptylhydroxylamine** and its salts, and reduction on oxidation (BEWAD), A., i, 631.
- Ethylcyclohexane** (*ethylnaphthene*) (KURSANOFF), A., i, 19, 89.
- Ethylidene chloride.** See Ethane, *as-dichloro*.
- α -Ethylidenelactic acid.** See Lactic acid.
- Ethylidene-oxanilide** and *p*-oxalotoluidide (V. PECHMANN and ANSEL), A., i, 287.
- Ethylisaurine** (*ethoxyformamidine*) (BIDDLE), A., i, 137.
- 2-Ethyl-4-ketodihydroquinazoline** (BOGERT and GOTTHELF), A., i, 412.
- Ethylmesityliodonium chloride** and platinichloride, *dichloro*- (WILLGERODT and ROGGATZ), A., i, 433.
- Ethyl-naphthene.** See *Ethylcyclohexane*.
- 1-Ethyl-naphthindolinonequinone-3-carboxylic acid**, ethylamine, other salts, and ethyl ester (LIEBERMANN), A., i, 310.
- Ethyl- β -naphthylamine**, action of benzaldehyde on (MORGAN), T., 1210; P., 1900, 171.
hydrochloride, action of formaldehyde on (MORGAN), T., 828; P., 1900, 181.
- Ethylloxalic anhydride** (BOUVEAULT), A., i, 474.
- o*-Ethylphenoxyacetal** (STOERMER), A., i, 652.
- Ethylphloroglucinol** and its triacetyl derivative (WEISWEILLER), A., i, 291.
- Ethylisopropylacetic acid.** See Heptolic acid.
- Ethylisopropylaniline** and its compounds with platinic chloride and the action of cyanogen bromide on (V. BRAUN), A., i, 642.
- β -Ethylpropylhydroxylamine** and its hydrochloride (BEWAD), A., i, 631.
- Ethyliso-propyl- and -butyl-thetine bromides** (STRÖMHOLM), A., i, 326.
- Ethylisopropylmalonic acid** and its ethyl ester (CROSSLEY and LE SUEUR), T., 83; P., 1899, 225.
- Ethylpyrrolidone** (TAFEL and STERN), A., i, 558.
- 1-Ethyl-2-quinolone**, luminosity of (DECKER), A., i, 688.
- 7-Ethylisorosindoneoxime** (FISCHER and HEPP), A., i, 461.
- β -Ethylsulphoneglutacenic acid** (POSNER), A., i, 8.
- Ethylthiophenyl-naphthaphenazonium chloride** (FISCHER and HEPP), A., i, 462.
- Ethyl- ψ -uric acid** and 3-Ethyluric acid and their salts (ARMSTRONG), A., i, 636.
- Eugenyl and isoEugenyl propyl ethers** (POND, MAXWELL, and NORMAN), A., i, 102.
- Euonymus arthropurpureus*, dulcitol in the bark of (HOEHNEL), A., ii, 427.
- Euonymus japonicus*, "honey" of (MAQUENNE), A., ii, 161.
- Evaporation**, relation between pressure and (HALL), A., ii, 9.
- Exalgin**, test for in antipyrine (RAIKOW and SCHARBANOW), A., ii, 456.
- Expansion of fused silica** (LE CHATELIER), A., ii, 539.
- Explosives**, use of ammonium perchlorate in the manufacture of (ALVISI), A., ii, 205.
relative stability of (BERTHELOT), A., i, 620.
- Explosive wave**, development and propagation of an (LE CHATELIER), A., ii, 647.

F.

- Fæces**, amylolytic and proteolytic fermenta in human (HEMMETER), A., ii, 607.
- xanthine bases in (PARKER), A., ii, 556.
- estimation of cellulose in (MANN), A., ii, 250.
- Fahlors.** See Tetrahedrite.
- Farmyard manure.** See Agricultural Chemistry.
- Fat**, formation of, in the organism by intensive feeding of fat (HENRIQUES and HANSEN), A., ii, 668.
human, composition and heat of combustion of (BENEDICT and OSTERBERG), A., ii, 491.
determination of the melting point of (JEAN), A., ii, 179.
transformation of, into glycogen (BORCHARD and DESGREZ), A., ii, 418.
rapidity of hydrolysis of (KREIS and WOLF), A., ii, 324; (LÜHRIG), A., ii, 667.
absorption of (HOFBAUER), A., ii, 605; (PFLÜGER), A., ii, 667; (FRIEDENTHAL), A., ii, 668.
rate of absorption and of assimilation of, during fasting (MOSSO), A., ii, 605.
absorption of, in the large intestine (HAMBURGER), A., ii, 418.
relative digestibility of certain, in the human intestine (LÜHRIG), A., ii, 224, 355, 667.

- Fat**, rancidity of (NAGEL), A., i, 271.
 apparatus for the extraction of (TAYLOR), A., ii, 115.
 in cartilage (SACERDOTTI), A., ii, 291.
 of human chyle, composition of (ERBEN), A., ii, 739.
 in glands (NIKOLAIDES), A., ii, 153.
 of normal and degenerated heart muscle (LINDEMANN), A., ii, 32.
 pathological (TAYLOR), A., ii, 606.
 from proteid (PFLÜGER), A., ii, 91, 92.
 meaning of the acetyl value in the analysis of (LEWKOWITSCH), A., ii, 323.
 bromine and iodine values of (WILLIAMS), A., ii, 633.
 the "inner saponification number" in the analysis of (FARRION), A., ii, 251.
 Welmans' phosphomolybdate test for the detection of (WELMANS; SOLTSEIN), A., ii, 697.
 detection of phytosterol and cholesterol in (KREIS and RUDIN), A., ii, 252.
 rapid estimation of the iodine number of (BELLIER), A., ii, 632.
 Hübl's iodine method for the estimation of (WELMANS), A., ii, 514.
 estimation of, in dairy produce (LINDERT), A., ii, 451.
 estimation of, in milk (TIMPE), A., ii, 179; (GALLIEN; MORINI; LÉZÉ), A., ii, 324; (RICHMOND), A., ii, 696.
 estimation of, in condensed milk (LEACH), A., ii, 771.
 estimation of, in sweetened condensed milk (GEISLER), A., ii, 771.
 estimation of, in sweetened condensed milk by the Babcock test (FARRINGTON), A., ii, 771.
 estimation of glycerol in (JEAN), A., ii, 694.
- Fats.** See also :—
 Butter.
 Lard.
 Margarine.
 Maripa fat.
 Milk.
 Wool fat.
- Fat extractor**, a multiple (PENNY), A., ii, 770.
- Fatty compounds**, configuration and classification of (KRAFFT), A., i, 577.
 saturated, configuration of (PETRENKO-KRITSCHENKO), A., i, 421.
- Fatty substances**, estimation of sugar in (POSSETTO), A., ii, 176.
- Fayalite**, altered, from the granulites of Villacidro (LOVISATO), A., ii, 736.
- Fedorowite** (VIOLE and KRAUS), A., ii, 662.
- Fehling's solution** (BULLNHEIMER and SEITZ), A., i, 380.
- Fenchane**, tribromo-, and the action of zinc dust and acetic acid on it (CZERNY), A., i, 675.
- Fenchene hydrobromide** (KONDAKOFF and LUTSCHININ), A., i, 605.
- Fenchocamphorone** and its reactions (WALLACH, NEUMANN, and V. WESTPHALEN), A., i, 241.
- Fencholenic acid**, isomeric (WALLACH), A., i, 241; (CZERNY), A., i, 675.
- Fenchone**, bromo-, and the action of alcoholic potash on (CZERNY), A., i, 675.
 pernitroso-, action of semicarbazide acetate on (RIMINI), A., i, 555.
- Fenchone series**, compounds of the (WALLACH, NEUMANN, and V. WESTPHALEN), A., i, 241.
- Fenchyl and isofenchyl alcohol** and their derivatives (BERTRAM and HELLE), A., i, 398; (KONDAKOFF and LUTSCHININ), A., i, 604.
- Fenchyl chlorides and bromides** (KONDAKOFF and LUTSCHININ), A., i, 604.
- Fenugreek.** See Agricultural Chemistry.
- Fermentation** and denitrification (WOLFF), A., ii, 298.
 of cellulose (OMELIANSKY), A., ii, 493.
 of trehalose (BAU), A., ii, 98.
 of yeast (LINTNER), A., ii, 296.
 by yeast in an antiseptic medium (DE REY-PAILHADE), A., ii, 678.
 with yeast extract (AHRENS), A., ii, 610.
 alcoholic, rate of (O'SULLIVAN), A., ii, 230.
 butyric acid (SCHATTENFROH and GRASSBERGER), A., ii, 230.
 schizomycetic (EMMERLING), A., ii, 742.
- Ferments.** See Enzymes and Yeast.
- Ferric compounds.** See under Iron.
- Ferricyanides**, oxidation of the nature of dehydrogenation by means of (ÉTARD), A., i, 301.
- Ferro-chromium**, estimation of silicon in (TATE), A., ii, 313.
- Ferrocyanides**, estimation of, in spent gas-purifying material (RIEHELMANN), A., ii, 111.
- Ferro-silicons**, presence of iron silicide in (LEBEAU), A., ii, 729.
- Ferrous compounds.** See under Iron.
- Fibres**, crude, König's process for the estimation of, in fodders (KELLNER, HERING, and ZAHN), A., ii, 250.
 vegetable, detection of (JANDRIER), A., ii, 177.
- Fibrin**, crystallised (MAILLARD), A., i, 266.

- Fibrin**, composition of (PICK), A., i, 68.
 digestion of, by papain (HARLAY), A., i, 419, 420.
 products of the peptic digestion of (PICK), A., i, 68.
- Filicic acid** (HAUSMANN), A., i, 49.
- Filters**, asbestos (LOHSE and THOMAS-CHIEWSKI), A., ii, 508.
- Fir-wood** (*Pinus Abies*), oil of (KLASON), A., i, 676.
- Fisetol diethyl ether** (v. KOSTANECKI and FEUERSTEIN), A., i, 355.
- Fish**, tinned (RÖSSING), A., ii, 513.
- Fish oils**, analysis of (BULL), A., ii, 250, 325.
- Flames**, coal gas, properties of (TECLU), A., ii, 71.
- o-Flavaniline** (2-o-aminophenyl-4-methyl-quinoline) and its acetyl derivative (CAMPS), A., i, 115.
- Flavaspidic acid** (HAUSMANN), A., i, 49.
- Flavinduline**, *mono-* and 2:7-*di-nitro-* and *mono-* and 2:7-*di-amino-* and their salts (KEHRMANN and KIKINE), A., i, 61.
 bromide, *mono-* and 2:7-*di-amino-* (KEHRMANN and KIKINE), A., i, 61.
- Flavindulines**, *nitro-* and *amino-* and their salts (KEHRMANN and STOFFEL), A., i, 254.
- Flavone**, synthesis of (v. KOSTANECKI, TAMBOR, and BONGARTZ), A., i, 239.
 derivatives (v. HARPE and v. KOSTANECKI), A., i, 237; (v. KOSTANECKI and SCHMIDT), A., i, 238; (v. KOSTANECKI and TAMBOR), A., i, 239; (BLUMSTEIN and v. KOSTANECKI), A., i, 448; (CZAJKOWSKI, v. KOSTANECKI, and TAMBOR), A., i, 504.
- Flax**. See Agricultural Chemistry.
- Flesh** and **proteids**, energy-value of (PFLÜGER), A., ii, 417.
- Flocculation** of liquids (SPRING), A., ii, 713.
- Florenceite** from Brazil (HUSSAK and PRIOR), A., ii, 601; (PRIOR), A., ii, 602.
- Flour**, gluten constituents of (GUSS), A., ii, 584.
- Fluids**, specific heat of (AMAGAT), A., ii, 525.
- Fluoran**, *dichlorodithio-* and *dithio-* (MEYER; MEYER and SZANECKI), A., i, 660.
- Fluorene**, refraction of (CHILESOTTI), A., i, 339.
 condensation product of (THIELE), A., i, 347.
- Fluoreneoxalic acid** and its ethyl ester (WISLICENUS), A., i, 346.
- Fluorescein**, *nitro-*derivatives, preparation and constitution of (HEWITT and PERKINS), T., 1324; P., 1900, 178.
mono- and *di-thio-* (MEYER; MEYER and SZANECKI), A., i, 660.
- Fluorescence** and chemical constitution (HEWITT and PERKINS), T., 1324; P., 1900, 178; (HEWITT), P., 1900, 3; A., ii, 618.
 of metallic compounds under the influence of Röntgen and Becquerel rays (BARY), A., ii, 330.
- Fluorine** in Swedish phosphorites (ANDERSSON and SAHLBOM), A., ii, 148.
 presence of, in teeth and bones (HARMS), A., ii, 29.
 in the mineral waters of Spain and Portugal (FERREIRA DA SILVA and D'AGUIAR), A., ii, 28.
 electrochemical properties of (ABEGG and IMMERWAHR), A., ii, 256.
 action of, on glass (MOISSAN), A., ii, 140.
- Hydrofluoric acid** (*hydrogen fluoride*), volumetric composition of (MOISSAN), A., ii, 271.
 heat of dissociation of (ABEGG), A., ii, 190.
 action of, on glass (MOISSAN), A., ii, 140.
- Fluorohyperborates** (MELIKOFF and LORDKIPANTDZE), A., ii, 138, 139.
- Fluorine**, detection of, in wine (PARIS), A., ii, 572.
- Fodders**, König's process for the estimation of crude fibre free from pentosan in (KELLNER, HERING, and ZAHN), A., ii, 250.
 See also Agricultural Chemistry.
- Fœtus**, human, fixation of alkali bases in the, and mineral statics of the, during the last five months of intrauterine life (HUGOUNENQ), A., ii, 418, 490.
- Food**, horseflesh as (PFLÜGER), A., ii, 490.
 sugar as (STROHMER), A., ii, 490.
 detection of coal-tar colouring matters in (WINTON), A., ii, 776.
 detection of "saccharin" in (TRICHON), A., ii, 377; (DE BRÉVANS), A., ii, 635.
 estimation of absorbable proteids in (BÜLOW), A., ii, 459.
- Food preservatives**, boric acid and formaldehyde as (RIDEAL and FOULERTON), A., ii, 560; (HEHNER), A., ii, 561.
- Formaldehyde**, formation of (FENTON), T., 1297; P., 1900, 148.

- Formaldehyde**, formation of, in plants (POLLACCI), A., ii, 160, 426.
 action of, on acridine and quinoline derivatives, and on alkaloids (KOENIGS), A., i, 189.
 action of, on anilides (GOLDSCHMIDT), A., i, 285, 436.
 action of, on β -aromatic hydroxylamines (BAMBERGER), A., i, 341.
 condensation of, with ethyl malonate (BOTTOMLEY and PERKIN), T., 294; P., 1900, 16.
 action of, on methylaniline (GOLDSCHMIDT), A., i, 436.
 action of, on amines of the naphthalene series (MORGAN), T., 814; P., 1900, 131.
 action of, on *o*-nitroaniline (MEYER and ROHMER), A., i, 222.
 action of potassium cyanide on (KOHN), A., i, 205.
 and isobutaldehyde, an aldol from (WÄRMELY), A., i, 428.
 compounds of, with bromal (PINNER), A., i, 427.
 compounds of, with substances belonging to the sugar group (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.
 as a food preservative (RIDEAL and FOULERTON), A., ii, 560; (HEHNER), A., ii, 561.
 physiological action of (BRUNI), A., ii, 359.
 comparison of some tests for (PILHASY), A., ii, 453.
 detection of (POLLACCI), A., ii, 160.
 detection and estimation of (CLOWES and TOLLENS), A., ii, 56.
 estimation of (VEREIN FÜR CHEMISCHE INDUSTRIE IN MAINZ), A., ii, 326; (WOLFF), A., ii, 373.
 estimation of, in the air (WINTGEN), A., ii, 117.
Paraformaldehyde, reactions of (HENRY), A., i, 537.
Formaldehydphenylbenzylhydrazone (RUFF and OLLENDORFF), A., i, 77.
Formasylbensenesulphonic acids, sodium salts of (FICHTER and SCHIESS), A., i, 366.
Formhydroxamic acid (BIDDLE), A., i, 138.
Formhydroxamoxime dibenzyl ether, and *p-di*-bromo- and -chloro-, and their acetyl derivatives (SCHROETER and PESCHKES), A., i, 485.
Formic acid, mixed anhydrides of (BÉHAL), A., i, 580.
 new hydroxylamine derivatives of (SCHROETER and PESCHKES), A., i, 485.
 estimation of (BÉHAL), A., i, 581.
Formic acid, estimation of, in presence of acetic acid (SPARRE), A., ii, 449.
Formic acid, methyl and ethyl esters, heat of combustion and of formation of (BERTHELOT and DELÉPINE), A., ii, 334.
 propyl ester, rate of hydrolysis of, at various temperatures (PRICE), A., ii, 528.
Formopyrine (*diantipyrimethane*), tetraiodide of, and compounds of, with phenols (PATEIN), A., i, 530.
Formoxime acetate and benzoate, chloro- (BIDDLE), A., i, 138.
 nitrate (BAMBERGER and MÜLLER), A., i, 145.
2-Formylaminoanisole, 5-chloro- (DIEPOLDER), A., i, 191.
***o*-Formylaminophenol** (BÉHAL), A., i, 581.
Formylanilide, bromo- and chloro-derivatives, and their acetyl and benzoyl derivatives (CHATTAWAY, ORTON, and HURTLEY), A., i, 151.
o-bromo- and -chloro-, nitrogen bromides and chlorides from (CHATTAWAY and ORTON), T., 800.
o-mono- and 3:5-*di*-bromo- and -chloro- (CHATTAWAY and ORTON), A., i, 643.
Formyl-*o*-anisidide (DIEPOLDER), A., i, 191.
1-Formylnaphthalide, 4-bromo- (CHATTAWAY and ORTON), A., i, 643.
2-Formylnaphthalide, 1-chloro- (CHATTAWAY, ORTON, and HURTLEY), A., i, 152.
Formylphenylacetic acid, ethyl ester, α - and β - (BRÜHL), A., i, 497.
 melting point of (WOLF), A., i, 345.
 esters, isomerism of (WISLICENUS), A., i, 597.
Formylphenylhydrazide, nitroso-, and **Formylphenylbenzylidenetriazan** (WOHL), A., i, 698.
Fractional distillation in a vacuum, receiver for (FOGETTI), A., ii, 535.
 under reduced pressure, apparatus for (ODDO), A., ii, 131.
 lecture experiment for demonstrating (RAIKOW), A., ii, 648.
Fractional precipitation of neutral salts, theory of the (FINDLAY), A., ii, 716.
Frankia subtilis, an organism producing nodules (HILTNER), A., ii, 426.
Freezing point, abnormal depressions of the, produced by chlorides and bromides of the alkaline earths (JONES and CHAMBERS), A., ii, 262.
 depression of the, by mixtures of electrolytes (BARNES), A., ii, 526.

- Freezing point** of aqueous solutions of acetic acid (DAHMS; DE COPPET), A., ii, 65.
 of aqueous solutions of non-electrolytes (LOOMIS), A., ii, 335.
 of hydrates of sulphuric acid (v. BIRON), A., ii, 74.
 of water, minimum in the molecular lowering of, produced by acids and salts (CHAMBERS and FRAZER), A., ii, 526.
 in dilute solutions, method of determining (WILDERMANN), A., ii, 262.
 in dilute solutions, errors in the determination of (WILDERMANN), A., ii, 131, 191; (BATELLI and STEFANINI), A., ii, 709.
- Freezing point curves** of alloys of antimony and tin (REINDERS), A., ii, 731.
 of mixed crystals (ROOZEBOOM), A., ii, 132; (VAN EIJK), A., ii, 133; (HIJSINK), A., ii, 339; (ADRIANI), A., ii, 463.
 of isomorphous mixtures (BRUNI and GORTI), A., ii, 197.
 for water containing hydrogen chloride and phenol (EMERY and CAMERON), A., ii, 335.
- Freezing point determinations** of the electrolytic dissociation of potassium and sodium sulphates (ARCHIBALD), A., ii, 65.
- Freezing point.** See also Cryoscopy.
- Friction, internal.** See Viscosity.
- Friedel-Crafts' reaction** (PERRIER), A., i, 331; (BOESKKE), A., i, 349; (KRONBERG), A., i, 502.
- Frog, respiration in the** (ATHANASIU), A., ii, 288.
 nitrogenous metabolism in the (v. MORACZEWSKI), A., ii, 31.
- d-Fructose.** See Levulose.
- Fruit products, detection of coal-tar colouring matters in** (WINTON), A., ii, 776.
- Fruit trees.** See Agricultural Chemistry.
- Fucose** from tragacanth (WIDTSOE and TOLLENS), A., i, 207.
- Fulminic acid**, relation of, to isocyanic acid (SCHOLL and KACER), A., i, 218.
 mercury salt, constitution and syn-
 thetical application of (SCHOLL), A., i, 144.
- Fulvene** (THIELE), A., i, 299.
- Fumaric acid** (*ethylendicarboxylic acid*), ethyl ester, condensation of, with benzyl cyanide (HENZE), A., i, 347.
- Fumaric acid**, chloro-, ethyl ester, condensation of, with benzamidine and guanidine (RUHEMANN and STAPLETON), T., 808; P., 1900, 122.
- Fumaric acid**, chloro-, ethyl ester, action of sodium phenoxide on (RUHEMANN and BEDDOW), T., 1123; P., 1900, 165.
- Fungi**, action of solutions of salts of fatty acids on (LÖVINSON), A., ii, 745.
- Furfuraldehyde** from beetroot and molasses (ANDRIJK), A., i, 110.
 action of Caro's reagent on (CROSS, BEVAN, and BRIGGS), A., i, 682.
 condensation of, with isobutaldehyde (LINDAUER), A., i, 305.
 detection of, in beer (HEIM), A., ii, 327.
 estimation of (CORMACK), T., 990; P., 1900, 156.
- Furfuraldehyde-p-nitrophenylhydrazones** (FEIST), A., i, 569.
- Furfuriminomethyl ether**, rearrangement of (WHEELER and ATWATER), A., i, 294.
- Furfurine**, an isomeride of (MILLINGTON and HIBBERT), P., 1900, 161.
- Furfuroids** of plant tissues (CROSS, BEVAN, and REMINGTON), A., ii, 611.
 physiological importance of, in sugar-beets (STOKLASA), A., ii, 100.
 distribution and importance of, in soils (STOKLASA), A., ii, 40.
- Furfurylacetic acid** (SANDELIN), A., i, 305.
- Furfurylacrylic acid** and the *allo*-acid, sublimation point of (LIEBERMANN and RIIBER), A., i, 648.
- Furfurylcarbinylsuccinic acid** (SANDELIN), A., i, 306.
- β -Furfuryl- α -p-chlorophenylacrylonitrile** (v. WALTHER and WETZLICH), A., i, 438.
- Furfuryl- α -cyanoacrylic acid**, ethyl ester (GUARESCHI), A., i, 53.
- 4-Furfuryldihydrodithiazine**, 2:6-dicyano- (HELLSING), A., i, 518.
- γ -Furfuryl- $\beta\beta$ -dimethylpropylene glycol** and its diacetate (LINDAUER), A., i, 305.
- Furfurylidene-bis-1-phenyl-3-methyl-5-pyrazolone** (TAMBOUR and LICINSKI), A., i, 365.
- γ -Furfurylpropane- $\alpha\beta\beta$ -tricarboxylic acid**, and its ethyl ester (SANDELIN), A., i, 306.
- β -Furfurylpropionic acid**, β -cyano-, and its ethyl ester (SANDELIN), A., i, 306.
- Furfurylsuccinamic acid** and its dibenzylidene derivative (SANDELIN), A., i, 306.
- Furfurylsuccinic acid** (SANDELIN), A., i, 306.
- Furnace**, tubular, giving fixed temperatures (GAUTIER), A., ii, 258.

Fusel oil, estimation of, in alcoholic liquids (ADAM), A., ii, 53; (BECKMANN and BRÜGGEMANN), A., ii, 175.

G.

Gadolinite from Batum (TSCHERNIK), A., ii, 551.

Gadolinium (DEMARÇAY), A., ii, 597.
and its compounds and salts (BENEDICKS), A., ii, 209.

Galactan, $C_6H_{10}O_5$ (EMMEBLING), A., ii, 743.

Galactase, the proteolytic ferment of milk, its properties, and action on the proteids of milk (BABCOCK and RUSSELL; v. FREUDENREICH), A., i, 712.

Galactosarabinose and its osazone and phenylbenzylhydrazone (RUFF and OLLENDORFF), A., i, 476.

Galactosamine, a new amino-sugar (SCHULZ and DITTHORN), A., i, 478.

Galactose from the albumen of the St. Ignatius bean and nux vomica (BOURQUELOT and LAURENT), A., ii, 498, 611.

from gulonic acid (FISCHER and RUFF), A., i, 539.

production of, by an enzyme (BOURQUELOT and HÉRISSEY), A., ii, 35, 233; (HÉRISSEY), A., ii, 561.

oxidation of, by hydrogen peroxide (MORRELL and CROFTS), T., 1219.

d-Galactose, degradation of (RUFF and OLLENDORFF), A., i, 476.

Galbanum, examination of (DIETERICH), A., ii, 118.

Galena, analysis of (MENNICKE), A., ii, 761.

Gallein and its esters, ethers, and acyl derivatives (ORNDORFF and BREWER), A., i, 447.

Gallic acid, thermochemistry of (MASOL), A., i, 499.

and tannic acid, estimation of (JEAN), A., ii, 632.

Gallin and its acetate and ether (ORNDORFF and BREWER), A., i, 448.

Galvanic elements. See Cells under Electrochemistry.

Ganglia, sympathetic, physiological action of extracts of (CLEGHORN), A., ii, 557.

Garnet, new variety of (MACLEOD and WHITE), A., ii, 663.

Gas, liquefaction of a, by "self-cooling" (NEWTH), P., 1900, 87.

fuel and illuminating, apparatus for the analysis of (THOMAS), A., ii, 169.

Gas, illuminating, estimation of benzene vapour in (PFEIFFER), A., ii, 173.

water, purification of, from iron carbonyl (VAN BRUKELEVEEN and TER HORST), A., ii, 348.

Gas analysis, technical (SCHMIDT), A., ii, 508.

burette for (WHITE), A., ii, 571.

Gas absorption apparatus (GAUTIER), A., ii, 366.

Gas washing apparatus (SCHALLER), A., ii, 48.

Gases, combustible, of atmospheric air (GAUTIER), A., ii, 537, 538, 720.

from the springs of Mont-Dore (PARMENTIER and HURION), A., ii, 415.

from the springs of Salsomaggiore (NASINI and SALVADORI), A., ii, 415.

influence of slight impurities on the spectra of (LEWIS), A., ii, 1, 701.

electrical conductivity in, traversed by cathode rays (MCLENNAN), A., ii, 587.

velocity of ions produced in, by Röntgen rays (ZELENY), A., ii, 587.

electrolytic, electrification of (KÖSTERS), A., ii, 4.

thermal conductivity of (SMOLUCHOWSKI and v. SMOLAN), A., ii, 68.

propagation of condensation waves in heated (LE CHATELIER), A., ii, 645.

determination of the molecular weight of, from their density (VAN DER WAALS), A., ii, 134.

relative rates of effusion of (DONNAN), A., ii, 390.

permanent, phenomena of effusion of (EMDEN), A., ii, 10.

apparatus for measuring volume of evolved (BENOIT), A., ii, 435.

apparatus for measuring evolved, at constant volume (JOB), A., ii, 434.

Gas generator, constant economical (KOENIG), A., ii, 718.

Gas-liquor, ammoniacal, estimation of carbon dioxide in (CHEVALET), A., ii, 170.

Gaseous mixtures, liquefaction of (CAUBET), A., ii, 191, 390, 646.

reactions in chemical kinetics (BODENSTEIN), A., ii, 12.

Gasometer, new (RIBAN), A., ii, 340.

Gastric juices, estimation of chlorine in (MEILLEKE), A., ii, 509.

estimation of combined hydrochloric acid in (COHNHEIM and KRIEGER), A., ii, 508, 778.

See also Stomach.

Gattermann's and Sandmeyer's reactions, electrolytic modification of (VOTOČEK and ZENÍŠEK), A., i, 19.

- Gaultherin** and **Gaultherase** from **Spiræas** (BEYERINCK), A., i, 108.
- Gelatin**, properties of (MÖRNER), A., i, 128.
- equilibrium between water, alcohol and (HARDY), A., ii, 896.
- condition of substances formed in, insoluble in water (DE BRUYN), A., ii, 136, 717.
- as a proteid-sparing food (KIRCHMANN), A., ii, 669.
- Genistein** and its methyl and ethyl ethers and their acetyl derivatives and decomposition products (PERKIN and HORSFALL), T., 1310; P., 1900, 182.
- Gentiopierin**, preparation of (BOURQUELOT and HÉRISSEY), A., i, 511.
- isoGeranic acid**, synthesis of (TIEMANN), A., i, 275.
- Geraniol**, estimation of, in oil of citronella (SCHIMMEL and Co.), A., ii, 175.
- isoGeraniolene** (TIEMANN), A., i, 275.
- Geranium oil**, constituents of (JEAN-CARD and SATIE), A., i, 242.
- Germination**. See **Agricultural Chemistry**.
- Gila monster**, physiological action of the poison of the (VAN DEUBURG and WIGHT), A., ii, 677.
- Ginger**, analysis of (CLAYTON), A., ii, 60.
- oil of, constituents of (v. SODEN and ROJAHN), A., i, 605.
- Glacial deposits** from Norway (HOLLAND and DICKSON), A., ii, 151.
- Glands**, fat in (NIKOLAIDES), A., ii, 153.
- lymphatic, chemistry of the (MENDEL and NAKASEKO), A., ii, 556.
- submaxillary, gaseous metabolism of the (BARCROFT), A., ii, 417.
- thymus, histon-like substances from (FLEROFF), A., i, 71.
- thymus and thyroid, iodine in the (MENDEL), A., ii, 152.
- thyroid, chemistry and physiology of the (OSWALD), A., ii, 358.
- effect of feeding with, on monkeys (EDMONDS), A., ii, 224.
- as a poison-removing organ (BLUM), A., ii, 224.
- of dogs, iodine in the (GLEY and BOURCET), A., ii, 555.
- of infants, variations of the iodine of the (CHARRIN and BOURCET), A., ii, 419.
- of sheep (SUIFFET), A., ii, 671.
- Glandular secretions**, defence of the organism against the toxic properties of (CHARRIN and LEVADITI), A., ii, 224.
- Glass**, composition of (ZULKOWSKI), A., ii, 595.
- bottle, composition of (DRALLE), A., ii, 482; (ZULKOWSKI), A., ii, 654.
- action of fluorine and hydrogen fluoride on (MOISSAN), A., ii, 140.
- Glass tubes**, calibration of (HULETT), A., ii, 397.
- Glauberite**, formation of, at 25° (VAN'T HOFF and CHIARAVIGLIO), A., ii, 284.
- Glaucocroite** from New Jersey (PENFIELD and WARREN), A., ii, 88.
- Glauconic acids** (DOEBNER), A., i, 313.
- Gluconasturtiin** (GADAMER), A., i, 49.
- Gluconic acid**, formation of (NIEBEL), A., i, 540.
- Glucoproteids** of white fibrous tissue (GIES and CUTTER), A., ii, 293.
- Glucosamine** (*chitosamine*) hydrochloride, behaviour of, in the organism (OFFER and FRÄNKEL), A., ii, 294.
- d-Glucose**. See **Dextrose**.
- l-Glucocephenylobenzylhydrasone** (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.
- Glucosides** containing thiocarbimides (TER MEULEN), A., i, 511.
- from parsley (PERKIN), T., 416; P., 1900, 44; (VONGERICHTEN), A., i, 681.
- from senna (TSCHIRCH and HIEPE), A., i, 681.
- in tobacco leaves (BEHRENS), A., ii, 239.
- from xanthorhamnin (C. and G. TANRET), A., i, 185.
- sugars of some (VOTOČEK), A., i, 355.
- $C_{20}H_{40}O_{15}$ (Wakamba arrow poison), (BRIGER), A., i, 243.
- Glucosides**. See also :—
- Agoniadin.
- Apigetrin.
- Anthraglucosennin.
- Apiin.
- Consolidin.
- Curangin.
- Gaultherin.
- Gentiopierin.
- Gluconasturtiin.
- Indican.
- Luteolin.
- Methyleneglucose.
- Myricetin.
- Myrosin.
- Phloridzin.
- Plumieride.
- Salinigrin.
- Spiræcin.
- Strophanthin.
- ψ -Strophanthin.
- Vitexin.
- Xanthorhamnin.

- Glue**, distinction between, and dextrin or gum arabic (BORNTRÄGER), A., ii, 631.
analysis of (FAHRION), A., ii, 59.
- Glutamic acid**, detection of, in animal proteids by sulphuric acid (KUTSCHER), A., i, 67.
- Glutaric acid**, (*n-pyrotartaric acid*; *propanedicarboxylic acid*), formation of (BOTTOMLEY and PERKIN), T., 300; P., 1900, 16.
methylenes, and methyl ester of (MEERBURG), A., i, 144.
 β -bromo- (β -SEMENOFF), A., i, 10.
bromo-, ethyl ester, action of alcoholic potash on (BOWTELL and PERKIN), P., 1899, 241.
- Glutaric derivatives**, synthesis of (GUARISCHI and GRANDE), A., i, 111; (MINOZZI), A., i, 406.
- Gluten meal**. See Agricultural Chemistry.
- Glutins**, hydrobromide and hydroiodide (PAAL), A., i, 467.
- Glyceric acid**, oxidation of, in presence of ferrous salts (FENTON and JONES), T., 72; P., 1899, 224.
- Glycerol** (*glycerin*), preparation of acrylic acid from (WÖHLK), A., i, 425.
some properties of (STRUVE), A., ii, 446.
estimation of, in fats and soaps (JEAN), A., ii, 694.
- Glycerophosphoric acid**, salts of (GUÉDRAS), A., i, 75.
- Glycerophosphoric acids**, velocity and limits of the formation of (IMBERT and BELUGOU), A., i, 130.
- Glyceryl acetodiformate** (BÉHAL), A., i, 581.
diiodohydrin, decomposition of (CHABON and SEAILLES), A., i, 472.
diisopropyl, *di-tert-butyl*, *dicapryl*, *dioctyl*, and *dibenzyl* ethers (ZU-NINO), A., i, 535.
nitrate, decomposition of, by alkalis (BERTHELOT), A., i, 620.
- Glycine** (*glycine*; *aminoacetic acid*), new derivative of (BALBIANO and TRACIATTI), A., i, 632.
- Glycocholic acid**, Hüfner's method of preparing pure (OSBORNE), A., ii, 419.
- Glycogen**, origin of, from proteid (SCHÖNDORFF), A., ii, 740.
preparation of (GAUTIER), A., i, 81; (BENDIX and WOHLGEMUTH), A., ii, 491.
amount of, in an organ, not extractable by water (NERKING), A., ii, 740.
- Glycogen**, formation of, after iulin feeding (NAKASEKO), A., ii, 670.
transformation of fat into (BOUCHARD and DESGREZ), A., ii, 418.
- Oxidation product of**, with bromine (NIEBEL), A., i, 540.
hepatic, increase of, during pregnancy (CHARRIN and GUILLEMONAT), A., ii, 292.
estimation of (GAUTIER), A., i, 81; (PFLÜGER), A., ii, 581.
estimation of, in horseflesh and preserved meats (BREUSTEDT; HAYWOOD), A., ii, 321.
- Glycol**. See Ethylene glycol.
- Glycollic acid** and its calcium salt (BÜTTINGER), A., i, 582.
oxidation of, in presence of ferrous salts (FENTON and JONES), T., 70; P., 1899, 224.
phenyl ester, reactions of (MOREL), A., i, 158.
- Glycollic aldehyde**, formation of α - and β -acrose from (JACKSON), T., 129; P., 1899, 238.
degradation of (FENTON), T., 1294; P., 1900, 148.
- Glycollic aldoxime** (FENTON), T., 1296; P., 1900, 148.
- Glycolloglycollic acid** (BÜTTINGER), A., i, 582; (WOLFF and LÜTTINGHAUS), A., i, 583.
- Glycollonitrile**, acetyl derivative, preparation of, and action of ammoniacal silver oxide on (FENTON), T., 1297; P., 1900, 148.
- Glycuronic acid** in normal urine (MAYER), A., ii, 155; (MAYER and NEUBERG), A., ii, 421.
phenylhydrazine derivatives of, and its detection (MAYER), A., i, 204.
- Glycyrrhiza glabra*, oil of (HAENSEL), A., i, 107.
- Glycyrrhizin**, estimation of, in liquorice extract (HAFNER), A., ii, 828, 775.
- Glyoxal**, condensation of, with *isobutaldehyde* (v. HOENBOSTEL and SIEBNER), A., i, 206.
- Glyoxaline-red**, formation of (RUHEMANN and STAPLETON), T., 809; P., 1900, 122.
- Glyoxime N-ethers**, aromatic (BAMBERGER), A., i, 341; (BAMBERGER and TSCHIRNER), A., i, 342.
- Glyoxylic acid** and its salts (BÜTTINGER), A., i, 582.
preparation of (DOEBNER), A., i, 473.
- Gold**, crystallisation of (DITTE), A., ii, 549.
- Gold alloys** with aluminium (HEYCOCK and NEVILLE), A., ii, 549.

- Gold alloys** with platinum, analysis of (PÄRWOZNIK), A., ii, 111.
- Gold compounds** with mercury, isomorphous (BEHRENS), A., ii, 213.
- Gold carbide** (MATHEWS and WATTERS), A., i, 323.
- chloride, hydrolysis of (KOHLEAUSCH), A., ii, 408.
- aurichlorides, abnormal, of organic bases (FENNER and TAFEL), A., i, 111.
- Gold, detection and estimation of:—**
- Gold,** detection of minute quantities of, in ores (DÖRING), A., ii, 371, 445.
- estimation of, iodometrically (GOOCH and MORLEY), A., ii, 110.
- estimation of small quantities of platinum in (RÖSSLER), A., ii, 733.
- Gonococcus** and its toxin (DE CHRISTMAS), A., ii, 742.
- Graftonite** from New Hampshire (PENFIELD), A., ii, 216.
- Grain.** See Agricultural Chemistry.
- Gramineæ.** See Agricultural Chemistry.
- Granatan-nucleus,** optical properties of the (PICCININI), A., i, 249.
- Granulite** from Cape Marsa (DUPARC and PEARCE), A., ii, 219.
- Grape Sugar.** See Dextrose.
- Grapes,** estimation of malic acid in (ORDONNEAU), A., ii, 250.
- Graphite** as a compressed powder, electrical conductivity of (STREINTZ), A., ii, 641.
- specific heat of, at low temperatures (BEHN), A., ii, 259.
- estimation of, by loss (AUCHY), A., ii, 313.
- Graphite mineral** from Moravia (KOVÁŘ), A., ii, 147.
- Graphitic acid** and ψ -Graphitic acid (STAUDENMAIER), A., ii, 15.
- Guaiaacol,** condensation of, with ethyl phenylpropionate (RUHEMANN and STAPLETON), T., 1180; P., 1900, 168.
- sodium, compounds of, with the ethyl esters of α -bromo-fatty acids (BISCHOFF), A., i, 396.
- estimation of, in wood-tar creosote (KEBLER), A., ii, 176.
- Guaiaacol, tri- and tetra-chloro-, and tetrabromo-,** action of nitric acid on (COUSIN), A., i, 179, 487.
- isomitroso-, ethers, and benzoyl and bromo-derivatives of (BRIDGE and MORGAN), A., i, 158.
- Guaiaacolecarboxylic acid,** methyl ester, nitro- and amino- (EINHORN), A., i, 440.
- Guaiaacoxyl-acetyl-, -malonyl-, and -propionyl-phenetidine** (BISCHOFF), A., i, 396.
- α -Guaiaacoxyl-propionic, -n- and -isobutyric, -malonic, and -isovaleric acids** and their ethyl esters (BISCHOFF), A., i, 396.
- Guanidine,** condensation of, with the ethyl esters of acetylenedicarboxylic and chlorofumaric acids (RUHEMANN and STAPLETON), T., 805; P., 1900, 122.
- action of, on ethyl phenylpropionate (RUHEMANN and STAPLETON), T., 242; P., 1900, 12.
- preparation of carbamide from (FLEMING), A., i, 280.
- derivatives of diacetoneamine (TRAUBE and SCHALL), A., i, 118.
- Guanine,** new synthesis of (TRAUBE), A., i, 416.
- Guano.** See Agricultural Chemistry.
- Gulonic acid,** conversion of, into xylose and galactose (FISCHER and RUFF), A., i, 539.
- L-Gulonic acid,** compounds of, with benzaldehyde and formaldehyde (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.
- Gum** in elm galls (PASSERINI), A., ii, 427.
- of *Grevillea robusta* (RÖSEK and PUAUX), A., i, 82.
- Gum tragacanth** (HILGER and DREYFUS), A., i, 379.
- arabinose, fucose and xylose from (WIDTSON and TOLLENS), A., i, 207.
- Gun-cotton,** tests for stability of (HOITSEMA), A., ii, 55.
- Guttapereha,** analysis of (BORNTÄGER), A., ii, 775.
- Gymnite** from Moravia (KOVÁŘ), A., ii, 148.
- Gypsum,** setting of (ZULKOWSKI), A., ii, 76.
- and anhydrite deposits at Oulx, Piedmont, minerals in the (COLOMBA), A., ii, 216.
- See also Calcium sulphate.

H.

- Hæmatic acid** (KÜSTER), A., i, 68, 319; (KÜSTER and KÖLLE), A., i, 69.
- Hæmatin,** neutral (ARNOLD), A., i, 318.
- preparation and oxidation of (KÜSTER), A., i, 68.
- obtained by the use of pepsin-hydrochloric acid (V. ZEYNEK), A., i, 711.
- decomposition products of (KÜSTER), A., i, 68, 319.
- Hæmatoporphyrin** and its salts and ethers (NENCKI and ZALESKI), A., i, 710.

Hematoporphyrin, preparation and oxidation of (KÜSTER and KÖLLE), A., i, 69.

spectrum of (ARNOLD), A., i, 127.

action of bromine on (MARCHLEWSKI and SCHUNCK), T., 1091; P., 1900, 149.

Hematoxin, action of, on man (METCHNIKOFF and BESREDKA), A., ii, 741.

Hematoxylin (GILBODY and PERKIN), P., 1899, 241.

constitution of (PERKIN and YATES), P., 1900, 108; (v. KOSTANECKI and FEUERSTEIN), A., i, 856.

as a photographic developer (LEPETIT), A., ii, 519.

Hematoxylon campechianum, constituents of (PERKIN), T., 426; P., 1900, 45.

Hæmin and its acetyl derivative and their ethers (NENCKI and ZALESKI), A., i, 709.

Hæmin crystals, preparation of (v. ZEYNEK), A., i, 711.

Hæmochromogen obtained by the use of pepsin-hydrochloric acid (v. ZEYNEK), A., i, 711.

Hæmoglobin, formation of, functions of the nucleus in relation to the (STASSANO), A., ii, 666.

absorption of oxygen and carbon monoxide by (DE SAINT-MARTIN), A., ii, 665.

action of chloroform and chloral hydrate on (FORMÁNEK), A., i, 532.

of the horse, amount of iron in the (LAPICQUE and GILARDONI), A., i, 467.

assimilation of iron by, and estimation of (ABDERHALDEN), A., ii, 223, 289, 416.

Methæmoglobin, formation of (v. ZEYNEK), A., i, 196; (HÜFNER), A., i, 267.

cysano- and photo- (HALDANE), A., i, 318.

Oxyhæmoglobin crystals from pigeons' blood (SCHWANTKE), A., i, 711.

Hæmorrhage, severe, infusion after (DAWSON), A., ii, 291.

and transfusion in dogs (DAWSON), A., ii, 291, 417.

Halogen compounds, organic, decomposition of, by sodium (LÖWENHERZ), A., ii, 338.

Halogens, specific gravity of the, at their boiling points (DRUGMAN and RAMSAY), T., 1228; P., 1900, 172.

law governing the elimination of, from the benzene ring (KLAGES and LIECKE), A., i, 387.

displacement of, from halogenated fatty acids (DE BARRÉ), A., i, 76.

VOL. LXXVIII. ii.

Halogens and hydroxyl, isomorphous replacement of (FELS), A., i, 338.

estimation of, in organic compounds (BERTHELOT; VALEUR), A., ii, 172.

Hamlinite (HUSSAK and PRIOR), A., ii, 601; (PRIOR), A., ii, 602.

Hancockite from New Jersey (PENFIELD and WARREN), A., ii, 88.

Hardystonite from Franklin furnace, New Jersey (WOLFF), A., ii, 735.

Hay. See Agricultural Chemistry.

Hazelnut oil (HANUS), A., ii, 101.

Heart, action of caffeine and theobromine on the (BOCK), A., ii, 424.

action of nicotine on the (WINTERBERG), A., ii, 424.

action of the toxic products of the typhoid bacillus on the (KEMP and DEWEY), A., ii, 559.

value of calcium and potassium ions on the (LOEB), A., ii, 491.

mammalian, excised, action of oxygen on a (STRECKER), A., ii, 491.

Heat. See Thermochemistry.

Hedenbergite from Dartmoor (BUSZ), A., ii, 217.

from Japan (JIMBÔ), A., ii, 87.

Helipora cœrulea. See Coral.

Helium, relative rates of effusion of, and of other gases (DONNAN), A., ii, 390.

solubility of, in water (ESTREICHER), A., ii, 205.

Hemicelluloses, estimation of, in plants (KLEIBER), A., ii, 630.

Hemimorphite from New Jersey (CLARKE and STEIGER), A., ii, 24.

Hemipinic acid, thermochemistry of (LEROY), A., ii, 261.

Metahemipinic acid (GILBODY and PERKIN), P., 1899, 241; (GILBODY, PERKIN, and YATES; PERKIN and YATES), P., 1900, 107.

Hemp. See Agricultural Chemistry.

Heptanaphthene. See Methylcyclohexane.

Heptane ($\beta\beta$ -dimethylpentane; trimethylpropylmethane) (MARKOWNIKOFF), A., i, 469.

Heptane (triethylmethane) nitration of (KONOWALOFF and KOTSINA), A., i, 324.

Heptanes in Grosny naphtha (CHARITSCHKOFF), A., i, 74.

cycloHeptanecarboxylic acid, tribromo- (BEAREN and BUCHNER), A., i, 292.

Heptanedicarboxylic acids. See:—Azelaic acid.

Methylisopropylglutaric acids.

Tetramethylglutaric acids.

Heptanetricarboxylic acid. See $\alpha\beta\beta$ -Trimethylbutane- $\alpha\alpha\beta$ -tricarboxylic acid.

- cyclo*Heptanone (*suberone*) peroxide (v. BAEYER and VILLIGER), A., i, 329.
- cyclo*Heptanoneisoxime (*suberonisoxime*) and its salts (WALLACH), A., i, 45.
- and its hydrolysis (WALLACH), A., i, 590.
- cyclo*Heptatrienecarboxylic acids, α - and β - (α - and β -isophenylacetic acids), affinity constants of (ROTH), A., ii, 590.
- cyclo*Heptenecarboxylic acids, Δ^1 - and Δ^2 - (BRAKEN and BUCHNER), A., i, 292.
- affinity constants of (ROTH), A., ii, 590.
- Heptenoic acids (WALLACH), A., i, 45, 590.
- Heptinene ($\beta\beta$ -dimethyl- $\beta\beta$ -pentadiene) (GRIGNARD), A., i, 382.
- Heptoleic acid (α -isopropylbutyric acid, ethylisopropylacetic acid) and its derivatives, preparation of (CROSSLEY and LE SUEUR), T., 89; P., 1899, 225.
- its ethyl ester, amide, anilide, and toluidide (CROSSLEY and LE SUEUR), T., 93; P., 1899, 225.
- α -bromo-, ethyl ester, action of diethylaniline on (CROSSLEY and LE SUEUR), T., 95; P., 1899, 225.
- Heptoleic acid ($\alpha\beta$ -trimethylbutyric acid) γ -cyano-, ethyl ester (THORPE and YOUNG), T., 939; P., 1900, 115.
- Heptoleic acid, ζ -bromo-, and ζ -iodo- (v. BAEYER and VILLIGER), A., i, 329.
- Heptoleic acids, amino- (WALLACH), A., i, 590.
- β -Heptylamine and its additive compounds (CLARKE), A., i, 83.
- γ -Heptylamine, and its salts and compound with phenylthiocarbimide (KIJNER), A., i, 277.
- Heptylene (γ -ethyl- β -amylene), nitrosate and nitrolanilide of (IPATIEFF), A., i, 3.
- Heptylhydrazine and its compound with phenylthiocarbimide (KIJNER), A., i, 277.
- β -tert. Heptylhydroxylamine and its hydrochloride (BEWAD), A., i, 632.
- Heroin. See Diacetylmorphine.
- Hessite from Mexico (HILLEBRAND), A., ii, 22.
- Heteroalbumose. See Albumose.
- Houlandite from Japan (JIMBŌ), A., ii, 88.
- Hexahydro-*p*-benzylaminocarboxylic acids, α - and β -, and their salts (EINHORN and LADISCH), A., i, 227.
- Hexahydrocymene, 2-chloro- (KLAGES and KRAITH), A., i, 43.
- Hexahydro-*p*-diethylbenzylaminocarboxylic acids, *cis*- and *trans*-, and their salts (EINHORN and PAPASTAVROS), A., i, 228.
- Hexahydromellitic acid and the isomerides of (DE STEFANI), A., i, 349.
- trans*-Hexahydrophthalic acid, optically active (WERNER and CONRAD), A., i, 100.
- Hexahydrotoluene. See Methylcyclohexane.
- Hexahydro-xylic acid. See Dimethylcyclohexanecarboxylic acid.
- Hexamethylene. See *cyclo*Hexane.
- Hexamethylenetetramine (*urotropine*), action of, on the esters of chloro- and bromoacetic acids (LOCQUIN), A., i, 589.
- halogen derivatives of (HOEHNEL), A., i, 279, 478.
- Hexamethyloctohydro-xanthenedione (VORLÄNDER and KALKOW), A., i, 100.
- Hexanaphthene. See *cyclo*Hexane.
- Hexane (*diisopropyl*), preparation, vapour pressures, specific volumes, and critical constants of (YOUNG and FORTEY), T., 1126; P., 1900, 165.
- Hexane ($\beta\beta$ -dimethylbutane), γ -amino- and the action of benzenesulphonic acid on (SOLONINA), A., i, 82.
- cyclo*Hexane (*hexamethylene*; *hexanaphthene*) (LUNGE and AKUNOFF), A., i, 543.
- purification of (MARKOWNIKOFF), A., i, 18.
- spectrum of (HARTLEY and DOBBIE), T., 846; P., 1900, 129.
- and *mono*- and *di*-chloro-, refraction and magnetic rotation of (YOUNG and FORTEY), T., 372; P., 1900, 44.
- chloro-, action of zinc methyl and of zinc ethyl on (KURSANOFF), A., i, 19.
- Hexanedicarboxylic acids. See:—
Dimethylethylsuccinic acid.
 β -isopropylglutaric acid.
Trimethylglutaric acid.
- Hexanetricarboxylic acid. See Dimethylbutanetricarboxylic acid.
- 2-*cyclo*Hexanonecarboxylic acid, bis-nitroso-, diethyl ester (DIECKMANN), A., i, 297.
- cyclo*Hexanoneisoxime and its hydrolysis (WALLACH), A., i, 590.
- cyclo*Hexane (*tetrahydrobenzene*) (LUNGE and AKUNOFF), A., i, 543.
- spectrum of (HARTLEY and DOBBIE), T., 846; P., 1900, 129.

- 8-*Hexenic acid*** and its salts (WALLACH), A., i, 590.
- Hexenoic acid** (*β-isopropylacrylic acid*), ethyl ester, condensation of, with ethyl sodiocyanoacetate (HOWLES, THORPE, and UDALL), T., 943; P., 1900, 116.
- Hexenoic acid** (*β-methylethylacrylic acid*) and its salts (POKROVSKY), A., i, 328.
- Hexethylidenetetramine** and its salts (KUDERNATSOH), A., i, 337.
- Hexinene** (*trimethylallylene*), action of hypochlorous and hypobromous acids on (WITTORF), A., i, 421.
- Hexoic acid** (*caproic acid*) amino- and ϵ -amino- (WALLACH), A., i, 589.
- as-diamino-*. See Lysine.
- isoHexoic acid** (*γ-methylvaleric acid*), barium and calcium salts, water of crystallisation of (ORNSTEIN), A., i, 7.
- Hexon bases**, isolation of, by benzoic chloride (LAWROFF), A., i, 110.
- Hexylamine** (*γ-amino-ββ-dimethylbutane*) and the action of benzenesulphonic acid on (SOLONINA), A., i, 82.
- β-Hexylamine** (v. BRAUN and STECHELE), A., i, 429.
- β-Hexylene**, nitrosate of (IPATIEFF), A., i, 3.
- Hexylenes** (*γ-methyl-β-amylene* and *δ-methyl-γ-amylene*), nitrosates and nitroanilides of (IPATIEFF), A., i, 3.
- Hippuric acid**, maximum production of, in rabbits (PARKER and LUSK), A., ii, 419.
- estimation of (BLUMENTHAL), A., ii, 770.
- Hippuroflavin**, constitution of (RÜGHEIMER), A., i, 609.
- homologues of (RÜGHEIMER and FEHLHAER), A., i, 609.
- Histidine** from the proteid of couifer seeds (SCHULZE and WINTERSTEIN), A., ii, 101.
- from the proteid of *Lupinus luteus* seedlings (SCHULZE), A., ii, 101.
- and its salts, rotatory power of (KOSSEL and KUTSCHER), A., i, 71.
- dichloride, crystalline form of (SCHWANTKE), A., i, 608.
- Histon** from leucocytes, decomposition products of (LAWROFF), A., i, 71.
- Hitchcockite** (HARTLEY), A., ii, 600; (PRIOR), A., ii, 602.
- Hollyhock flowers**, composition of (ZAY), A., ii, 563.
- Homocamphanic acid**, formation of (LAPWORTH), T., 1066; P., 1900, 128.
- α-Homocamphoramic acid**, formation of (LAPWORTH), T., 1061; P., 1900, 128.
- Homocamphoric acid** and its bromination (LAPWORTH), T., 1053; P., 1900, 128.
- α -bromo-, and its diethyl ester, action of bases on (LAPWORTH), T., 1066; P., 1900, 129.
- Homocamphoric dianilide** (LAPWORTH), T., 1063.
- Homocamphoronic acid** (LAPWORTH and CHAPMAN), T., 309; P., 1900, 4.
- bromination of (LAPWORTH and CHAPMAN), T., 452; P., 1900, 56.
- β-Homocyclidone** (MURRILL and SCHLOTTERBECK), A., i, 686.
- Homocyclo-cinchenine** and *cinchenic acid*, and their ethyl ethers (KOENIGS), A., i, 247.
- Homodihydroisolaurenamine** and its salts (BLANC), A., i, 240.
- γ-Homodypnopinacone**, and the action of acetic chloride on (DELAURE), A., i, 603.
- Homologues**, regularities in the melting points of (SALZER), A., ii, 260.
- Hops**, distinguishing between quassia and (CHAPMAN), A., ii, 380.
- See also Agricultural Chemistry.
- Hornblende** from Portland, Maine (LORD), A., ii, 603.
- Horseflesh**, use of, as food (PFLÜGER), A., ii, 490.
- distribution of glycogen in (HAYWOOD), A., ii, 321.
- estimation of glycogen from (BREUSTEDT; HAYWOOD), A., ii, 321.
- Horses**. See Agricultural Chemistry.
- Humus**, estimation of, in soil (ASCHMAN and FABER), A., ii, 60; (EMERY), A., ii, 516.
- Hundertkräuter-Likör** (*Centerba*), composition of (PARIS), A., ii, 446.
- Hura crepitans*, milky juice of (SURIE), A., ii, 680.
- Hydrazine**, transformation of hyponitrous acid into (v. BRACKEL), A., ii, 594.
- electrolysis of (SZARVASY), T., 605; P., 1900, 3.
- action of, on thiocarbamides (BUSCH and BAUER), A., i, 414.
- hydrate, action of, on lactones (WEDEL), A., i, 363.
- salts, isomerism of, with salts of ammonium, and of hydroxylamine (SABANÉEFF), A., ii, 13.
- sulphate, oxidation of, by platinum black (SABANÉEFF), A., ii, 14.
- Hydrazines**, oxidation of (KIJNER), A., i, 384.
- as-alkyl aromatic*, action of aromatic nitroso-derivatives on (BAMBERGER and STIEGELMANN), A., i, 193.
- secondary, compounds of, with aromatic aldehydes (LABHARDT and v. ZEMBRZUSKI), A., i, 125.

- Hydrazinosalicylic acid** (AUDEN), P., 1899, 231.
- Hydrazobenzene**, oxidation of, by atmospheric oxygen (BISTRZYCKI), A., i, 815.
- nitro-derivatives of (WERNER and STIASNY), A., i, 194.
- Hydrazoic acid**. See Azoimide.
- Hydrasolepidine** and its salts (MARCKWALD and CHAIN), A., i, 521.
- Hydrazone-compounds** differentiated from azo-compounds by bromine (ARMSTRONG), P., 1899, 243.
- Hydrazones** of dithiocarbonates (BUSCH and LINGENBRINK), A., i, 66, 411.
- 2-Hydrazoquinoline** and its salts (MARCKWALD and MEYER), A., i, 520.
- Hydrindamine chloro- and bromo-camphorsulphonates** and *cis- π -camphanates*, isomeric, (KIPPING), T., 861; P., 1900, 51.
- Hydrindene** (MOSCHNER), A., i, 344.
- Hydrindenesulphonic acid** (MOSCHNER), A., i, 344.
- Hydrobenzoin dinitrate** (v. WALTHER and WETZLICH), A., i, 438.
- Hydrocarbon** (b. p. 172-173°·5), from *d*-carvone (TSCHUGAEFF), A., i, 352. (m. p. 112-183°), obtained by the oxidation of mesitylene (WEILER), i, 284.
- C_6H_{10} , from dimethylallylcarbinol (LUBARSKY), A., i, 422.
- C_7H_{10} , from terecantallic acid and calcium acetate (MÜLLER), A., i, 678.
- $C_{10}H_{16}$, from oil of savin (FROMM), A., i, 402.
- $C_{15}H_{24}$, and $C_{20}H_{32}$, from poplar oil (FICHTER and KATZ), A., i, 108.
- $C_{18}H_{26}$, from the action of phosphoric oxide on phenylisobutyramide (WALLACH), A., i, 229.
- $C_{18}H_{26}$, from colophony (KRAEMER and SPILKER), A., i, 150.
- $C_{21}H_{34}$, from mineral oil (KLAUDY and FINK), A., i, 284.
- Hydrocarbons** from dyppone (DELACRE) A., i, 603; (GESCHÉ), A., i, 604.
- from ethereal oils (SCHIMMEL and Co.), A., i, 184.
- from the distillation, under pressure, of lubricating oils (KRAEMER and SPILKER), A., i, 617.
- from Californian, Japanese, and Pennsylvanian petroleum (MABERY), A., i, 533.
- in Roumanian petroleum (PONI), A., i, 617.
- in heavy Texas petroleum (MABERY and BUCK), A., i, 577.
- Hydrocarbons with high melting points** from petroleum resin (ZALOZIECKI and GANS), A., i, 593.
- synthesis of (GIGNARD), A., i, 382.
- preparation of, by the hydrogenation of acetylene and ethylene (SABATIER and SENDRENS), A., i, 197, 469, 470, 471, 534.
- preparation of, by the oxidation of hydrazines (KIJNER), A., i, 334.
- vapour pressures of a series of (WORINGER), A., ii, 709.
- relation between the boiling point and melting point in (BAYLEY), A., i, 369.
- aromatic, magnetic behaviour of (FREITAS), A., ii, 708.
- complex aromatic, action of oxygen on derivatives of the (MANCHOT), A., i, 300.
- fatty, preparation of halogen derivatives of (MOUNEYBAT), A., i, 577.
- saturated, preparation of (WOLKOFF and MENSCHUTKIN), A., i, 321.
- unsaturated, new method of preparation of (TSCHUGAEFF), A., i, 129.
- unsaturated, from the action of silver oxide on bromoamines with tertiary amino-groups (KIJNER), A., i, 629.
- methods of analysis of (MABERY and CLYMER), A., ii, 439.
- Hydrocarbons**. See also:—
- Acetylene.
 - Allylene.
 - Amylenes.
 - Anthracene.
 - Araliene.
 - Benzene.
 - Benzylideneffluorene.
 - 1-Benzylindene.
 - Bornylene.
 - isoButane.
 - Butinene.
 - Butylbenzenes.
 - Butylene.
 - Butyltoluenes (*methylbutylbenzenes*).
 - Butylxylene.
 - Cadinene.
 - Camphane.
 - Camphene.
 - Campholene.
 - Caryophyllene.
 - Carvomenthene.
 - Cinnamene.
 - Crakene.
 - ψ -Cumene (1:3:4-triethylbenzene).
 - Cuprene.
 - Cymenes.
 - Dibenzyl.
 - Diisobutyl (*octane*).
 - Diisobutylmethane.
 - Dihydrocamphenes.

Hydrocarbons. See:—

Dihydrocymene.
ββ-Dimethylbutane (*hexane*).
 1:3-Dimethyl-5-butylbenzene (*butyl-xylene*).
 Dimethylfulvene.
ββ-Dimethyl-*ββ*-pentadiene (*heptinene*).
ββ-Dimethylpentane (*heptane*).
 Dimethylstyrene.
 Dinaphthanthracene.
 Dinaphthyl.
 Diphenyl.
 Di-*m*-phenylenediethene.
 Diphenylmethane.
 Diisopropyl (*hexane*).
 Di-*m*-tolylmethane.
 Dixylylene.
 Dypnopinalcolene.
 Ethane.
 γ -Ethyl-*β*-amylene (*heptylene*).
 Ethylbenzene.
 Ethylene.
 Ethylnaphthene (*ethylcyclohexane*).
 Fenchane.
 Fluorene.
 Fulvene.
*iso*Geraniolene.
 Heptane.
 Heptinene.
 Heptylene.
 Hexahydrocymene.
 Hexahydrotoluene (*methylcyclohexane*).
 Hexamethylene (*cyclohexane*).
 Hexanaphthene (*cyclohexane*).
 Hexane.
*cyclo*Hexane.
*cyclo*Hexene.
 Hexinene.
 Hexylene.
 Hydrindene.
 Indene.
 Isoprene (*pentinene*).
 Lekene.
 Limonene.
 Menthane.
 Menthene.
 Mesitylene.
 Methane.
 γ -Methyl-*β*-amylene (*heptylene*).
 δ -Methyl- γ -amylene (*heptylene*).
β-Methylantracene.
 Methylbutylbenzenes.
 γ -Methyl-*β*-butylene (*amylene*).
 Methylcyclohexane (*hexahydrotoluene*).
 Methylcyclohexenes.
i-Methylindene.
 Methylnaphthalenes.
 Methylnaphthene (*methylcyclohexane*).
 4-Methylstyrene.
 Naphthalene.
 Naphtanthracene.

Hydrocarbons. See:—

Octane.
*cyclo*Pentadiene.
 3:5:2':4':6'-Pentamethyldiphenylmethane.
 Pentane.
*cyclo*Pentane.
 Pentinene (*isoprene*).
 Petrocenes.
 Phenanthrene.
 Phenylacetylene.
 Phenyldiphenylene-ethylene.
 Phenylethane.
 Phenylethylene.
 Phenylfulvene.
 Phenylmethane.
 Phenylmethylacetylene.
 Phenylmethylfulvene.
 2-Phenylnaphthalene.
 Phenylstyrene.
 Phenyltolylmethane.
 Phenylxylylethane.
 Picene.
 Pinene.
 Polymethylenes.
 Polyprene.
 Propane.
 Propylbenzenes.
 Propylene.
*iso*Propylstilbene.
 Retene.
 Sabinene.
 Santalenes.
 Santene.
 Sesquiterpenes.
 Stilbene.
 Styrene.
 Terpadinene.
 Terpene.
 1:2:3:4-Tetraethylbenzene.
 Tetrahydrobenzene.
 Tetrahydrocymene.
 Tetrahydrotoluene (*methylcyclohexane*).
s-Tetramethyldibenzyl.
 Tolane.
 Toluene.
p-Tolylacetylene.
 Tolyethylene.
 1:3:4-Triethylbenzene (ψ -*cumene*).
 Triethylmethane.
 Trimethylallylene (*hexinene*).
 Trimethylene (*cyclopentane*).
 Triphenylbenzene.
 Triphenylmethane.
 Xylenes.
 Xylylene.
 Zingiberine.
Hydrocele fluid, composition of (VERTUN), A., ii, 152.
Hydrochloric acid. See under Chlorine.

- Hydro-p-coumaric acid**, identity of, with phloretic acid (BOUGAULT), A., i, 495.
- Hydrocyanic acid**. See under Cyanogen.
- Hydroembellic acid** (HEFFTER and FEUERSTEIN), A., i, 498.
- Hydroferrocyanic acid**, constitution of, decomposition of, in air, action of heat and of ether on (BROWNING), T., 1238; P., 1900, 172.
decomposition of (ADIE and BROWNING), T., 157; P., 1899, 226.
and carbonylhydroferrocyanic acid, comparison of heat of fractional neutralisation of (MULLER), A., ii, 130.
- Hydrogallein**, non-existence of (ORNDORFF and BREWER), A., i, 448.
- Hydrogasometer** (BENOIT), A., ii, 435.
- Hydrogen**, existence of free, in the atmosphere (GAUTIER), A., ii, 537, 538.
spectra of (TROWBRIDGE), A., ii, 701.
absorption coefficient of, by aqueous solutions of dissociating substances (BRAUN), A., ii, 529.
density of, dried by liquid air (RAYLEIGH), A., ii, 589.
liquid, influence of the temperature of, on the germinative power of seeds (THISELTON-DYER), A., ii, 300.
influence of the temperature of, on Bacteria (MACFADYEN and ROWLAND), A., ii, 610.
occlusion of, by cobalt and nickel (BAXTER), A., ii, 78.
deviation from Boyle's law of mixtures of carbon dioxide and (VERSCHAFFELT), A., ii, 192.
and mixtures of hydrogen and methane and air, limits of combustibility of, passed over red-hot cupric oxide (GAUTIER), A., ii, 469.
influence of finely divided platinum on the combination of oxygen and (FRENCH), A., ii, 718.
action of, on antimony sulphide (PÉLABON), A., ii, 352.
action of, on mercury selenide, and the inverse action (PÉLABON), A., ii, 346.
estimation of, volumetrically (COLSEN), A., ii, 241.
- Hydrogen bromide**. See under Bromine.
- Hydrogen chloride**. See under Chlorine.
- Hydrogen cyanide**. See under Cyanogen.
- Hydrogen fluoride**. See under Fluorine.
- Hydrogen iodide**. See under Iodine.
- Hydrogen nitride**. See Azoimide.
- Hydrogen peroxide** (BRÜHL), A., ii, 535.
preparation of (DE FORCRAND), A., ii, 129.
- Hydrogen peroxide**, demonstration of the formation of, as a product of direct oxidation (ENGLER), A., i, 400.
its acyl derivatives and their peroxides, nomenclature of (v. BAEYER and VILLIGER), A., i, 626.
dielectric constant of (CALVERT), A., ii, 831.
chemical dynamics of (BREDIG and MÜLLER v. BERNECK), A., ii, 213.
heat of solution of (DE FORCRAND), A., ii, 526.
heat of neutralisation of (DE FORCRAND), A., ii, 476.
equilibrium between persulphuric acid and (LOWRY and WEST), T., 955; P., 1900, 127.
action of, on barium hydroxide (DE FORCRAND), A., ii, 277.
action of, on carbohydrates, in presence of ferrous salts (MORRELL and CROFTS), T., 1219; P., 1900, 171.
action of, on unsaturated hydrocarbons, in presence of ferrous sulphate (CROSS, BEVAN, and HEIBERG), A., i, 534.
action of, on lime (DE FORCRAND), A., ii, 526.
action of permanganate on (v. BAEYER and VILLIGER), A., ii, 719.
action of, on nitrogen iodide (CHATTAWAY and ORTON), A., ii, 722.
interaction of, with sulphuric acid (LOWRY and WEST), T., 950; P., 1900, 126.
estimation of (GRÜTZNER), A., ii, 310.
estimation of, iodometrically (RUFF), A., ii, 572.
- Hydrogen peroxides**, higher (BACH), A., ii, 470.
- Hydrogen tetroxide**, Bach's (ARMSTRONG), P., 1900, 134.
- Hydrogen phosphide** (*phosphine*), preparation of (MATIGNON), A., ii, 482.
action of, on mercuric chloride (PARETHEIL), A., ii, 543.
- Hydrogen sulphide** and its solution, preparation of (WINKLER), A., ii, 598.
dissociation constant of (WALKER and CORMACK), T., 14; P., 1900, 208.
action of, on bismuth, lead or silver peroxides (VANINO), A., ii, 279.
estimation of (RUSSELL), T., 354; P., 1900, 41.
- Hydrolysis**. See Affinity.
- Hydroxamic acids**, action of amines on (THIELE and PICKARD), A., i, 29.
- Hydroxyacetyl-p-acetaminobenzoic acid** and its salts (TROEGER), A., i, 227.

- Hydroxy-acids**, aromatic, and their esters (EINHORN), A., i, 439.
haloid, formation of (MELIKOFF), A., i, 536.
- β -Hydroxy-acids**, dibasic, behaviour of, on boiling with aqueous sodium hydroxide (FICHTER and DREYFUS), A., i, 426.
- 3-Hydroxy-5-alkyl-1:3:4-triazole-1-propionic acids** from acylsemicarbazino-propionic acids, and their acyl derivatives (BAILEY and ACREE), A., i, 528.
- Hydroxyamidodisulphates**, decomposition of, by copper sulphate (DRIVERS and HAGA), T., 978; P., 1900, 147.
- Hydroxyamino-acids**, aromatic, glycinyl derivatives of the esters of (EINHORN and OPPENHEIMER), A., i, 493.
- 3-Hydroxy-3- and -4- α -amylamino-benzoic acids**, their esters and nitroso-derivatives (EINHORN and HÜTZ), A., i, 442.
- Hydroxyazobenzene** and *p*-aminophenol, action of sulphur on a mixture of (RIS), A., i, 419.
- o*-Hydroxyazobenzene** (BAMBERGER), A., i, 531.
- Hydroxyazo-compounds**, constitution of (MCPHERSON), A., i, 123; (AUWERS and MANN), A., i, 418.
action of sulphur on a mixture of *p*-aminophenol, *m*-amino-*o*-cresol, or *p*-phenylenediamine (RIS), A., i, 419.
- Hydroxyazoxybenzenes**, *o*-, *p*-, and *iso-o*-, and their oxidation (BAMBERGER), A., i, 531.
- p*-Hydroxybenzaldehyde triacetate** (THIELE and WINTER), A., i, 500.
- m*-Hydroxybenzamide**, *s*-tribromo-, and its triacetyl derivative (VAN DAM), A., i, 172.
- Hydroxybenzamides**, *o*-, *m*-, and *p*-, action of potassium hypobromite on (VAN DAM), A., i, 171.
- o*-Hydroxybenzoic acid**. See Salicylic acid.
- m*-Hydroxybenzoic acid**, 2:4:6-triamino-5-cyano, and its triacetyl derivative, and amide (NIETZKI and PETRI), A., i, 486.
- 2- and 6-mono-, and 2:6-di-chloro-** (MAZZARA and BERTOZZI), A., i, 596.
- Hydroxybenzoic acids**, *m*- and *p*-, glycinyl derivatives of the esters of (EINHORN and OPPENHEIMER), A., i, 494.
- Hydroxybenzoic acids**, ethyl esters, compounds of, with the ethyl esters of α -bromo-fatty acids (BISOHOFF), A., i, 396.
their esters, acyl derivatives, and nitro- and amino-compounds (EINHORN), A., i, 439.
- Hydroxybenzonitrile**, 2:4-dinitro- (BORSCHKE), A., i, 645.
- 1-Hydroxy-1:2:3-benzotriazole** (*benzene-aziminol*) and the action of acetic chloride on (ZINCKE and SCHWARZ), A., i, 527.
- m*-Hydroxybenzyl alcohol**, bromide, chloride and iodide, 2:4:6-tribromo-, and the acetyl derivatives of the alcohol and bromide (AUWERS and RICHTER), A., i, 165.
haloids, relation between structure of, and reaction of, with alkalis (AUWERS), A., i, 159.
- p*-Hydroxybenzyl alcohol**, bromide and iodide, 3:5-dibromo-, their acetyl derivatives, and ethers of the alcohol (AUWERS and DÄCKE), A., i, 164.
- o*-Hydroxybenzylacetanilide**, 4:6-di-bromo- (AUWERS), A., i, 492.
- m*-Hydroxy-benzyl- and -benzylidene-aniline** (BAMBERGER and MÜLLER), A., i, 705.
- α -Hydroxybenzylideneacetophenone** and its reactions (WISLICIENUS), A., i, 37.
- Hydroxybenzylideneaminodi-*p*-tolyl-guanidine** (BUSCH and BAUER), A., i, 415.
- o*-Hydroxybenzylidenebis-2-methyl-indole** (v. WALTHER and CLEMEN), A., i, 408.
- Hydroxybenzylidene-2-naphthylamine**, 1-bromo- and 1-chloro-*o*- and *p*-, and their hydrocyanides (MORGAN), T., 1216; P., 1900, 171.
- 2-Hydroxy-1-benzyl- α -naphthindole-quinone** and its carboxylic acid (LIEBERMANN), A., i, 311.
- o*-Hydroxybenzyl-*p*-tolylnitrosoamine** (BAMBERGER and MÜLLER), A., i, 706.
- α -Hydroxybutaldoxime** (FRANKE), A., i, 428.
- Hydroxybutyric acid** in diabetic urine (MAGNUS-LEVY), A., ii, 155.
- Hydroxybutyric acids**, α - and β -, β - and α -bromo- (MELIKOFF), A., i, 536.
- Hydroxycamphenilanic acid** (BREDT and JAGELKI), A., i, 135.
- α -Hydroxycamphopyric acid** (GARDNER), P., 1900, 46.
- 4-Hydroxy-carbostyryl** from anthranilic acid (ERDMANN), A., i, 188.
- 4-Hydroxyisocarbostryl** and its 3-carboxylic acid (GABRIEL and COLMAN), A., i, 858, 859.
- Hydroxyapocinchonic lactone**, and its ethyl ether (KOENIGS), A., i, 246.
- Hydroxyapocinchonine** (KOENIGS), A., i, 246.

- 4-Hydroxy- ψ -cumyl alcohol**, haloids, and ethers, 3:6-dibromo-, acetyl derivatives of (AUWERS, TRAUN, and WELDE), A., i, 165, 168.
- 5-Hydroxy- ψ -cumyl alcohol** and bromide and bromo-derivatives, ethers and acetyl derivatives of (AUWERS), A., i, 161; (AUWERS and MAAS), A., i, 162.
- p*-**Hydroxy- ψ -cumyl bromide**, phenylurethane of (AUWERS, TRAUN, and WELDE), A., i, 167.
- 5-Hydroxy- ψ -cumylene dibromide**, 3:6-dibromo-, its ethers and acetyl derivatives (AUWERS; AUWERS and EBNER), A., i, 161.
- p*-**Hydroxy- ψ -cumylene *o*-glycol**, dibromo-, ethers of (AUWERS and EBNER), A., i, 161.
- 3-Hydroxy-2:6-dicarboxy-1:4-pyronic acid**. See Meconic acid.
- 2'-Hydroxy-3:4'-diethoxychalkone** and its acetyl derivative (v. HARPE and V. KOSTANECKI), A., i, 237.
- 1-Hydroxy-3:4'-dimethoxy- and -3:4'-diethoxy-flavone** (CZAJKOWSKI, v. KOSTANECKI, and TAMBOR), A., i, 504.
- 6-Hydroxy-1:5-dimethoxyphenanthrene**. See α - ψ -Thebaol.
- 6-Hydroxy-1:5-dimethoxyphenanthrene-10-carboxylic acid**. See α - ψ -Thebaol-carboxylic acid.
- 2-Hydroxy-4:5-dimethylbenzaldehyde** (AUWERS), A., i, 160.
- 8-Hydroxy-5:7-dimethylfluorone** and its acetyl derivative and methyl ether (WEIDEL and WENZEL), A., i, 308.
- α -Hydroxy- α -dimethylheptioic acid** (α -hydroxy- α -methylisohexylacetic acid), and its methyl ester (AUWERS), A., i, 9.
- ϵ -Hydroxy- β - ϵ -dimethyloctoic acid**, ethyl ester and lactone of (v. BAER and VILLIGER), A., i, 329.
- 2-Hydroxydiphenyl**, 5-nitro-, and its benzoyl derivative (BORSCHKE), A., i, 594.
its benzoyl and 5-nitroso-, and 5-amino-derivatives (BORSCHKE), A., i, 24, 594.
- o*-Hydroxydiphenylacetic hydrazide** and its benzylidene derivative and compound with *o*-phthalaldehydic acid (WEDEL), A., i, 363.
- 2-Hydroxy-1:3-diphenylbenzene**, 5-nitroso- and its benzoyl derivative, and 5-amino- (BORSCHKE), A., i, 25, 594.
- p*-Hydroxydiphenylcarbamide** and its phenylcarbamate (FISCHER), A., i, 418.
- Hydroxyethanesulphonic acid**, energy of (COJAZZI), A., i, 327.
- 3'-Hydroxy-3-ethoxyflavone** and its acetyl derivative (v. HARPE and V. KOSTANECKI), A., i, 238.
- 1:4-Hydroxyethoxynaphthalene** (RUSIG), A., i, 602.
- Hydroxyethoxynaphthalene-2-carboxylic acid** and its esters (RUSIG), A., i, 601.
- 4-Hydroxy-3-ethylisocarbostyryl** (GABRIEL and COLMAN), A., i, 358.
- Hydroxyethylideneoxanilide** (v. PECHMANN and ANSEL), A., i, 389.
- 2-Hydroxyethyl-4-methylpyridine (2:4-lutidylalkine)**, formation of (ENGELS), A., i, 406.
- 2-Hydroxy-1-ethylnaphthindolequinone** (LIEBERMANN), A., i, 311.
- Hydroxyethylpiperidines** (*piperidine-alkines*), physiological action of (PADERI), A., ii, 742.
- Hydroxyethylsulphenomethylenesulphinic acid** (KÖTZ), A., i, 370.
- 4'-Hydroxyflavone** and its acetyl derivative (GROSSMANN and V. KOSTANECKI), A., i, 669.
- 5-Hydroxyfurfuran-2-carboxylic acid** (CROSS, BEVAN, and BRIGGS), A., i, 682.
- 6-Hydroxy-4-furfuryl- $\Delta^{3,4}$ -dihydropyridone**, 3:5-dicyano- (GUARESCHI), A., i, 53.
- β -Hydroxyglutaric acid**, distillation of (FICHTER and KRAFFT), A., i, 8.
- ζ -Hydroxyheptioic acid**, its ethyl esters and salts (v. BAER and VILLIGER), A., i, 329.
- α -Hydroxyhomocamphoric acid**, lactone of. See Homocamphanic acid.
- p*-Hydroxyhydratropic acid** (BOUGAULT), A., i, 549.
- 5-Hydroxyhydrindene** (MOSCHNER), A., i, 344.
- Hydroxyl** and halogens, isomorphous replacement of (FELS), A., i, 338.
alcoholic, phenylthiocarbimide as a reagent for the detection of (ORNDORFF and RICHMOND), A., i, 156.
phenolic, influence of (MASSOL), A., i, 600.
- Hydroxyl-function**, thermal value of (DE FORCRAND), A., ii, 526.
- Hydroxylamine**, preparation of free (UHLENHUTH), A., ii, 475.
spectrum of (HARTLEY and DOBBIE), T., 321; P., 1900, 14.
electrolysis of (SZARVASY), T., 608 : P., 1900, 3.
oxidation of (v. KNORRE and ARNDT), A., ii, 204.
action of, on bromoamines (KIJNER), A., i, 277, 333.

- Hydroxylamine**, action of, on ethyl β -cyanophenylpyruvate (ERLENMEYER), A., i, 649.
 action of, on ethyl phenylpropiolate (RUHEMANN and STAPLETON), T., 240; P., 1900, 11.
 reactions of, with hydroxy- and unsaturated compounds (TINGLE), A., i, 544.
 salts, isomerism of, with salts of ammonium and of hydrazine (SABANIEFF), A., ii, 18.
 hydrochloride, gradual decomposition of, when impure (DIVERS and HAGA), T., 978; P., 1900, 147.
 action of, on ketones of the type $\text{CO}(\text{CH}:\text{CHR})_2$, in presence of sodium acetate (MINUNNI and CARTA-SAITTA), A., i, 237.
 formic acid derivatives of (SCHROETER and PESCHKES), A., i, 485.
 nickel sulphate compound of (UHLENHUTH), A., ii, 482.
 platinum compounds of (UHLENHUTH), A., ii, 485, 659.
- Hydroxylamines**, aromatic, nature and position of substituents in, in their reaction with nitrocompounds (ANGELI and ANGELICO), A., i, 221.
 action of alkalis on (BAMBERGER and BRADY), A., i, 221.
 oxidation of aqueous solutions of, by atmospheric oxygen (BAMBERGER), A., i, 220.
 β -aromatic, action of diazomethane on (BAMBERGER and TSCHIRNER), A., i, 342.
 action of formaldehyde on (BAMBERGER), A., i, 341.
- 1-Hydroxylaminocamphane** (β -bornylhydroxylamine) (FORSTER), T., 255; P., 1900, 14.
- 7(t)-Hydroxylepidone** and its acyl derivatives (v. PECHMANN), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.
- α -Hydroxymandelic aldehyde** and its osazone and semicarbazone (STORMER), A., i, 656.
- Hydroxymercuribenzoic acid**, and anhydride, and its salts (PESCI), A., i, 546.
- 4-Hydroxymethyl alcohol**, and methyl ether, 2,6-dibromo-, and their acetyl derivatives (AUWERS, TRAUN, and WELDE), A., i, 166, 169.
 alcohol, 2,6-dibromo- (AUWERS and TRAUN), A., i, 167.
- p -Hydroxymesitylaniline**, dibromo-, phenylurethanes of, and acetyl derivative (AUWERS, TRAUN, and WELDE), A., i, 166.
- p -Hydroxymesitylene-aldehyde**, -imine-ether, and -nitrile (THIELE and EICHWEDE), A., i, 501.
- Hydroxymethanesulphonic acid**, energy of (COJAZZI), A., i, 327.
- 4- p -Hydroxy- m -methoxybenzylidenebis-1-phenyl-3-methyl-5-pyrazolone** (TAMBOR and LICIŃSKI), A., i, 364.
- 3-Hydroxy-5-methoxy-2-methylphenol** and its hydrochloride and tetracetyl derivative (KONYA), A., i, 545.
- 3-Hydroxy-5-methoxy-2-methyl- p -quinone** and its 4-oxime, and p -quinol and its triacetyl derivative (KONYA), A., i, 545.
- 1,4-Hydroxymethoxynaphthalene** (RUSIG), A., i, 602.
- Hydroxymethoxynaphthalene-2-carboxylic acid**, and its esters (RUSSIG), A., i, 601.
- 3-Hydroxy-4-methoxyphenanthrene** (isomethylmorphol), synthesis of, and its acetyl derivative and 9-carboxylic acid (PSCHORR and SUMULEANU), A., i, 487.
- 7-Hydroxy-8-methoxy-3-phenyl-2-carboxtyril** (PSCHORR and SUMULEANU), A., i, 488.
- 6-Hydroxy-4- p -methoxyphenyl- $\Delta^{3,6}$ -dihydropyridone**, 8:5-dicyano- (GUARIESCHI), A., i, 52.
- Hydroxymethyl- α -benzoiesulphinide**, synthesis of (MASELLI), A., i, 596.
- 1-Hydroxy-6-methyl-1:2:3-benzotriazole** (toluencaziminol) (ZINCKE and SCHWARZ), A., i, 528.
- 4-Hydroxy-3-methylisocarbostyryl** (GABRIEL and COLMAN), A., i, 358.
- 6-Hydroxy-2-methylchromone**, and its acetyl derivative (CRIVELLI and v. KOSTANECKI), A., i, 668.
- 7-Hydroxy-2-methylchromone** (BLOCH and v. KOSTANECKI), A., i, 308.
- 2-Hydroxy-3-methyldiphenyl-5-nitroso-**, and its benzoyl derivative (BORSCHKE), A., i, 594.
- Hydroxymethylenetropinone** (WILLSTÄTTER and IGLAUER), A., i, 244.
- 2-Hydroxy-4-methyl-3-ethylquinoline** (CAMPS), A., i, 310.
- 8-Hydroxymethylfluorone** (WEIDEL and WENZEL), A., i, 308.
- β -Hydroxy- β -methyl- ϵ -heptenoic acid** and its ethyl ester (v. BRAUN and STECHELE), A., i, 429.
- Hydroxymethylhexoic acid** and its ethyl ester and silver salt (v. BAEYER and VILLIGER), A., i, 329.
- α -Hydroxy- α -methylisohexylacetic acid**. See α -Hydroxy- α -dimethylheptoic acid.

- 2-Hydroxymethyl-5-phenyl-3-triazol-one-1-propionic acid** (BAILEY and ACREE), A., i, 528.
- 4-Hydroxy-1-methylpyrazole** and its salts (WOLFF), A., i, 692.
- 6-Hydroxy-4-methylpyrimidine**, hydriodide of (GABRIEL and COLMAN), A., i, 55.
- Hydroxymethylquinolines**, 2:4- and 4:2-, synthesis of (CAMPS), A., i, 115.
- 4-Hydroxy-3-methylisoquinoline**, 1-chloro- (GABRIEL and COLMAN), A., i, 359.
- Hydroxymethylquinoxaline** (RUHEMANN and STAPLETON), T., 249; P., 1900, 12.
- 4-Hydroxy-2-methyltrimesic acid** and its esters (ERRERA), A., i, 33.
- 8-Hydroxynaphthalene-4:6-disulphonic acid**, 1-amino- (*aminonaphthol-K-acid*), use of, for the detection of nitrous acid in water (ERDMANN), A., ii, 243; (SPIEGEL), A., ii, 318; (MENNICKE), A., ii, 438, 621.
- Hydroxynaphthalic anhydride**, and derivatives (ANSELM and ZUCKMAYER), A., i, 175.
- Hydroxynaphthaloxime** and its diacetyl derivative (ANSELM and ZUCKMAYER), A., i, 176.
- Hydroxynaphthaquinone** and its acetyl derivative (THIELE and WINTER), A., i, 505.
- 2-Hydroxy- α -naphthaquinone-3-acetic acid** (LIEBERMANN), A., i, 311.
- 2-Hydroxy-1-naphthylacetic acid** and bromo-, and their lactones; and di-chloro- (STOERMER), A., i, 656.
- 2-Hydroxyisonicotinic acid**, 6-chloro-, and 6-amino- (SELL and DOOTSON), T., 236; P., 1900, 9.
- Hydroxydinitrobenzenesodiphenylaminesulphonic acid**, sodium salt (GNEHM and WERDENBERG), A., i, 94.
- Hydroxypentanesulphonic acid**, energy of (COJAZZI), A., i, 327.
- 3-Hydroxyphenanthrene** and its acetyl derivative (PSCHORR and SUMULEANU), A., i, 488.
- 4-Hydroxyphenanthrene**, synthesis of, and its methylether and acetyl derivative (PSCHORR and JAECKEL), A., i, 488.
- o*-Hydroxyphenoxyacetic acid**. See Catecholacetic acid.
- m*-Hydroxyphenoxyacetic acid** (*resorcinolacetic acid*), and its silver salt and anilide (CARTER and LAWRENCE), T., 1222; P., 1900, 152.
- p*-Hydroxyphenoxyacetic acid** (*quinolacetic acid*) and its aniline salt and anilide (CARTER and LAWRENCE), T., 1222; P., 1900, 152.
- o*-Hydroxyphenylacetic acid**, and its amide, chloride, and lactone; and 5-chloro- and its lactone (STOERMER), A., i, 656.
- 2-Hydroxyphenylacetic acid**, 5-nitro-, and its ethyl ester and lactone (HILL, SOCH, and OENSLAGER), A., i, 538.
- m*-Hydroxyphenylaminocrotonic acid**, ethyl ester (v. PECHMANN), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.
- Hydroxyphenyleoumalin** (HESSE), A., i, 35.
- 4-*o*-Hydroxyphenyldihydrodithiazine**, 2:6-dicyano- (HELLSING), A., i, 518.
- 6-Hydroxy-4-phenyl- $\Delta^{3,6}$ -dihydropyridone**, 3:5-dicyano- (*dicyanophenylglutacetonimide*), and its salts (GUARENCHL), A., i, 52.
- o*-Hydroxyphenylmethylurethane** and its benzoyl derivative (RANSOM), A., i, 219.
- 4-Hydroxy-1-phenylpyrazole**, and its 3-carboxylic acid (WOLFF), A., i, 692.
- 2-Hydroxy-4-phenylquinoline** (CAMPS), A., i, 310.
- 5-Hydroxy-1-phenyltriazole** and its 3-benzyl, 3-methyl, and 3-ethyl derivatives (RUPE and LABHARDT), A., i, 258.
- 2-Hydroxy-1-phenyl-4:4:6-trimethyldihydropyrimidine** (TRAUBE and SCHALL), A., i, 118.
- o*-Hydroxyphenylurethane** from *o*-aminophenyl ethyl carbonate, and its benzoyl derivative (RANSOM), A., i, 218.
- p*-Hydroxyphthalaldehyde**, tribromo-, its isomeride, and acetyl derivatives (AUWERS and BURROWS), A., i, 99.
- p*-Hydroxyphthalanil**, dibromo-, preparation of (MEYER), A., i, 447.
- 5-Hydroxyisophthalic acid**, 2:4:6-triamino-, and its tetracetyl derivative (NIETZKI and PETRI), A., i, 486.
- 3-Hydroxypiperidone**, preparation of (EMMERLING), A., i, 16.
- Hydroxyvalic acid** (WESSELY), A., i, 428.
- 8-Hydroxypropaldehydediethylacetal** (WOHL and EMMERICH), A., i, 627.
- α -Hydroxypropionic acid**. See Lactic acid.
- α -Hydroxyisopropyl- γ -hexenoic acid** (RUPE), A., i, 372.
- Hydroxypropyldienoxanilide** (v. PECHMANN and ANSEL), A., i, 389.
- 4-Hydroxy-2-propylquinoline** (CAMPS), A., i, 310.
- 4-Hydroxypyrazole** and its 3-carboxylic acid (WOLFF), A., i, 691.
- 2-Hydroxypyridine**, 3:4:5:6-tetrachloro- (SELL and DOOTSON), T., 772.

6-Hydroxypyrimidine, 2:4-*di*- and 2:4:5-*tri*-amino- (TRAUBE), A., i, 416.

Hydroxypyrimidinecarboxylic acid, amino-, ethyl ester of (RUHEMANN and STAPLETON), T., 808; P., 1900, 122.

Hydroxypyruvic acid, constitution of (ABERSON), A., i, 200.

8-Hydroxyquinoline, fate of, in the organism (ROST), A., ii, 154.

Hydroxyquinolines, 2- and 4-, syntheses of (CAMPS), A., i, 115, 310.

4-Hydroxyisoquinoline, 1-chloro- (GABRIEL and COLMAN), A., i, 358.

8-Hydroxyquinolinecarboxylic acid, its esters, and nitro- and amino-derivatives (EINHORN), A., i, 441.

o-Hydroxyquinolineglycuronic acid (BRAHM), A., ii, 95.

o-Hydroxyquinolinesulphonic acid, physiological action of (BRAHM), A., ii, 95.

See also Quinosol.

Hydroxystearic acid and its acetyl derivative (KASANSKY), A., i, 426.

Hydroxystyrogallol (2:3:6-*tri*hydroxy-*anthracoumarin*), preparation and triacetyl derivative of (SLAMA), A., i, 177.

Hydroxysulphonaphthalic anhydride (ANSELM and ZUCKMAYER), A., i, 175.

Hydroxyterephthalic acid, esterification of (WEGSCHEIDER and BITTNER), A., i, 658.

8-Hydroxy-s-tetramethylglutaric acid, action of hydriodic, hydrobromic, and sulphuric acids and nitrogen oxides on; and its isomeride (MICHAILENKO and JAVORSKY), A., i, 586.

3-Hydroxy-o-tolualdehyde and its oxime (AUWERS), A., i, 96; (AUWERS and BURROWS), A., i, 99.

5-Hydroxy-o-tolualdehyde, 3:4:6-*tri*- and *aa*:3:4:6-*penta*-bromo- and its acetyl and benzoyl derivatives and oxime (AUWERS), A., i, 96; (AUWERS and BURROWS), A., i, 98.

Hydroxytoluic acid (Me:OH:CO₂H:Br=1:2:3:5) (THIELE and EICHWEDE), A., i, 501.

3-Hydroxy-o-toluic acid, 4:6-*di*bromo- (AUWERS and BURROWS), A., i, 99.

p-Hydroxytoluic acid (*p-cresotic acid*), phenylester, reactions of, with phenols (COHN), A., i, 548.

Hydroxytoluic acids, their esters and nitro- and amino-derivatives (EINHORN), A., i, 439.

p-Hydroxytoluquinone and its acetyl derivative (THIELE and WINTER), A., i, 505.

2-Hydroxy-1-tolyl-4:4:6-trimethyl-dihydropyrimidine (TRAUBE and SCHALL), A., i, 118.

1-Hydroxy-1:2:3-triazole-4:5-dicarboxylic acid (*aziminolethylenedicarboxylic acid*) and its salts (ZINCKE and SCHWARZ), A., i, 528.

8-Hydroxy- $\alpha\beta$ -trimethyladipic acid and its esters (BLAISE), A., i, 329.

7(1)-Hydroxy-2:4:4-trimethyl-3:4-dihydroquinoline (v. PECHMANN), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.

γ -Hydroxyvaleric acid, 8-amino-, barium salt of (EMMERLING), A., i, 16.

lactam of. See 3-Hydroxypiperidone.

4-Hydroxy-m-xylene glycol, tribromo-, and its methyl ether (AUWERS and HAMPE), A., i, 96.

Hydroxy-o-xylene glycols, tribromo-, and their ethers (AUWERS and EGGELT), A., i, 97.

Hygic acid (1-methylpyrrolidine-2-carboxylic acid), synthesis of (WILLSTÄTTER), A., i, 405.

Hyoscine, constitution of (HESSE), A., i, 50; (GADAMER), A., i, 356.

i-**Hyoscine**. See Atroscine.

Hyoscyamine, constitution of (HESSE), A., i, 50; (GADAMER), A., i, 356.

Hyoscyamus niger, estimation of the alkaloids of the leaves of (SCHMIDT), A., ii, 379.

Hyperacids, thermochemistry of (PISSARJEWSKY), A., ii, 466.

Hypnal, estimation of (BOUGAULT), A., i, 311.

I.

Ice calorimeter, Bunsen's (MELLOR), A., ii, 334.

Iceland spar as a standard in volumetric analysis (MASSON), A., ii, 436; (THIELE and RICHTER), A., ii, 620.

Iditol, *d*- and *l*-, benzylidene and methylene derivatives of (DE BRUYN and ALBERDA VAN EKENSTEIN), A., i, 382.

compounds of, with formaldehyde (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.

***l*-Idonic acid**, compound of, with formaldehyde (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.

***l*-Idosaccharic acid**, compound of, with benzaldehyde (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.

Imidosulphites (DIVERS and OGAWA), P., 1900, 113.

- Imino-chlorides**, decomposition of (v. PECHMANN and OBERMILLER), A., i, 294.
- Iminodicarboxylic acid**, oxime of (*imino-hydroxamic acid*) (BAMBERGER and MÜLLER), A., i, 145.
- Imine-ethers**, molecular rearrangement of, by heat (WISLICENUS and GOLDSCHMIDT), A., i, 435.
- action of alkyl iodides on (WHEELER), A., i, 293.
- reactions of, with phenylcarbimide, phenylthiocarbimide and acylthiocarbimides (WHEELER and SANDERS), A., i, 563.
- Incineration**, apparatus for (TUCKER), A., ii, 52; (SHUTTLEWORTH and TOLLENS), A., ii, 111; (SHUTTLEWORTH), A., ii, 372.
- Indene**, new syntheses of (KIPPING and HALL), T., 467; P., 1900, 54.
- alkylation of (MARCKWALD), A., i, 434.
- condensation product of (THIELE), A., i, 347.
- Indenexalic acid** and its ethyl ester (WISLICENUS), A., i, 346; (THIELE), A., i, 347.
- Indene resin** (KRAEMER and SPILKER), A., i, 656.
- Indexing chemical literature**, system of (HILL), A., ii, 648.
- Indiarubber**. See Caoutchouc.
- Indican** (BEYERINCK), A., i, 230, 403; (HAZEWINKEL), A., i, 403; (HOOGWERFF and TER MEULEN), A., i, 404.
- occurrence of, in the chlorophyll grains of the indigo plant (MOLINCH), A., ii, 101.
- oxidation product of, in urine (COTTON), A., ii, 293.
- detection of, in pathological urine (KLETT), A., ii, 776.
- estimation of, in urine (WANG), A., ii, 122; (BOUMA), A., ii, 700.
- Indican enzyme**. See under Enzymes.
- Indicanuria** produced by the administration of oxalates (HARNACK and v. D. LEYEN), A., ii, 422.
- Indicator**, new, for acidimetry (WOLFF), A., ii, 435.
- alizarin-green-B as an (FORMÁNEK), A., ii, 435.
- ferric isopyrottritarate as an (SIMON), A., i, 625.
- p-nitrophenol as an (SPIEGEL), A., ii, 754.
- perezone as an (DUYK), A., ii, 308.
- Indicators**, wide occurrence of, in nature (FRAPS), A., ii, 754.
- See also Analysis.
- Indigo**, formation of, from Indigoferae and from *Marsdenia tinctoria* (VAN ROMBURGH), A., i, 230.
- distinction of, from other blue dyes on fabrics (VAN LEENT), A., ii, 457.
- assay of (CLAUSER), A., ii, 180.
- Indigotin**, formation of, from diphenyl-diketopiperazine (KUHARA and CHIKASHIGE), A., i, 560.
- formation of, from ethyl anthranilate (VORLÄNDER and KOETTNITZ), A., i, 649.
- formation of, from woad (BEYERINCK), A., i, 230, 403, 649.
- crystalline form of (KLEY), A., i, 346.
- fusion of, with potassium hydroxide (HENTSCHEL), A., i, 231.
- oxidation of (v. GEORGEVICS and SPRINGER), A., i, 560.
- Indigotintrisulphonic acid**, salts of (HÖNIG), A., i, 231.
- Indigo-white**, crystalline (BINZ and RUNG), A., i, 560.
- Indium**, microchemical detection of (HUYSE), A., ii, 245.
- Indoles**, substituted, action of alkyl iodides on (PLANCHER), A., i, 560.
- Indoline bases**, syntheses of (BRUNNER), A., i, 360.
- 1-Indene, 3-bromo-, and its oxime (SCHLOSSBERG), A., i, 665.
- Indonecyanoacetamide**, chloro-, and **Indonedicarboxyloglutaseonic acid**, bromo-, ethyl ester (LANSER and WIEDERMANN), A., i, 666.
- Indonecyanoacetic acid**, ethyl ester (SCHLOSSBERG), A., i, 666.
- Indonemalonic acid**, chloro-, derivatives of (LANSER and WIEDERMANN), A., i, 666.
- Indoneresorcinol ether**, bromo-, and its acetyl derivative (LANSER and WIEDERMANN), A., i, 667.
- Indoxylanilide** (VORLÄNDER and WEISSBRENNER), A., i, 295.
- Induline dyes**, electrolytic preparation of (SZARVASY), T., 207; P., 1899, 194.
- Infants**, new-born, chemical composition of (CAMERER and SÖLDNER), A., ii, 290.
- comparison of the feeding of, on human and cows' milk (MÜLLER), A., ii, 422.
- naturally and artificially fed, mineral metabolism in (BLAUBERG), A., ii, 669.
- metabolism in (CAMERER and SÖLDNER), A., ii, 222.
- excretion of sulphur by (FREUND), A., ii, 226.

- "Influence,"** thermal value of the coefficient of (DE FORCRAND), A., ii, 527, 528.
- Infusion** after severe hæmorrhage (DAWSON), A., ii, 291, 417.
- Infusoria**, action of fluorescent substances on (RAAB), A., ii, 425.
effect of stimuli on (GARREY), A., ii, 158; (JENNINGS), A., ii, 158, 425.
- Inorganic compounds**, constitution of (WERNER, MÜLLER, KLIEN, and BRÄUNLICH), A., i, 86.
substances, phosphorescence of (GOLDSTEIN), A., ii, 702.
- Inositol**, physiological rôle of (POSTERNAK), A., ii, 679.
- Intestinal contents**, chemical reaction of (MOORE and BERGIN), A., ii, 154.
- Intestine**, absorption and excretion of iron by the (ABDERHALDEN), A., ii, 223, 289, 416; (HOFMANN), A., ii, 491.
absorption of sugars in the (HÉDON), A., ii, 223.
large, absorption of fats and soaps in the (HAMBURGER), A., ii, 418.
small, absorption in the (COHNHEIM), A., ii, 289.
absorption of saline solutions by the (WALLACE and CUSHNY), A., ii, 31.
excretion in the (CORLETTE), A., ii, 673.
human, relative digestibility of certain fats in the (LÜHRIG), A., ii, 224, 355, 667.
sandy matter from the (THOMSON and FERGUSON), A., ii, 228.
reduction of cholesterol to coprosterol in the (MÜLLER), A., ii, 289.
- Intramolecular change** of bromodiazonium chloride into chlorodiazonium bromide (HANTZSCH and SMYTHE), A., i, 315.
rearrangement (AUWERN), A., i, 492.
- Inulin** from chicory (WOLFF), A., ii, 37.
glycogen-forming properties of (NAKASEKO), A., ii, 670.
- Invertase**, presence of, in some plants of the Gramineæ (O'SULLIVAN), T., 691; P., 1900, 61.
- Iodine** in corals (MENDEL), A., ii, 677.
recovery of, from the residues obtained in the preparation of zinc ethyl (LACHMAN), A., i, 542.
atom, configuration of the (KIPPING and PETERS), P., 1900, 62.
molecular weight of, in various solvents (ODDO and SERRA), A., ii, 73.
action of, on aconitine and caffeine (KIPPENBERGER), A., ii, 777.
- Iodine**, action of, on alkalis (TAYLOR), T., 725; P., 1900, 70.
action of, on gaseous ammonia (HUGOT), A., ii, 274.
behaviour of, with mercuric oxide (ORTON and BLACKMAN), T., 835; P., 1900, 104.
action of persulphates on (MARSHALL), A., ii, 203.
in the blood (GLEY and BOURCET), A., ii, 555.
in the thymus and thyroid (MENDEL), A., ii, 152.
in the thyroid of dogs (GLEY and BOURCET), A., ii, 555.
of the thyroid of infants, variations of the (CHARRIN and BOURCET), A., ii, 419.
influence of, on the circulation (BARBERA), A., ii, 291.
metabolism of (GAUTIER; BOURCET), A., ii, 670.
absorption of, by plants (BOURCET), A., ii, 100.
- Iodine compounds**, effect of very low temperatures on the colour of (KASTLE), A., ii, 526.
- Iodine mono- and tri-chloride**, molecular weight of, in various solvents (ODDO and SERRA), A., ii, 73.
monochloride, reaction of, with alkalis (ORTON and BLACKMAN), T., 830; P., 1900, 103.
- Hydriodic acid** (*hydrogen iodide*), and metallic iodides, action of, on sulphur dioxide (PÉCHARD), A., ii, 398; (BERG), A., ii, 535; (VOLHARD), A., ii, 650.
- Iodides**, absorption of, by the skin (GALLARD), A., ii, 419.
- Iodic acid**, use of, in analysis (JÖRGENSEN), A., ii, 620.
detection of, in presence of chloric, perchloric, bromic, and periodic acids, by means of morphine sulphate (REICHARD), A., ii, 685.
- Iodates and hypiodites**, estimation of (ORTON and BLACKMAN), T., 830; P., 1900, 103.
- Iodine compounds**, organic, heats of combustion and formation of (BERTHELOT), A., ii, 387.
- Iodides**, aromatic, oxidation of, by Caro's reagent (BAMBERGER and HILL), A., i, 281.
- Iodine**, detection, estimation, and separation of:—
starch test for (NORRIS and FAY), A., ii, 272.
estimation of (AUZENAT), A., ii, 366.
estimation of, electrometrically (CROTOGINO), A., ii, 642.

- Iodine, detection, estimation and separation of:**—
 estimation of, in presence of bromine and chlorine (V. WESZELSKY), A., ii, 436.
 separation of, from bromine and chlorine (CROTOGINO), A., ii, 642.
 separation of, from chlorine (VANINO and HAUSER), A., ii, 165.
- Iodine reaction, Florence's (STRUVE), A., ii, 328.**
- Iodoform, electrolytic synthesis of (DONY-HÉNAULT), A., i, 577.**
 estimation of, volumetrically, in dressings (LEHMANN), A., ii, 372, 767.
- Iodoso- and Iodoxy-compounds, preparation of (WILLGERODT), A., i, 339; (ORTOLEVA), A., i, 592.**
- Iodethyria, influence of, on the circulation (BARBERA), A., ii, 291.**
- Ionone, examination of violet preparations for (SCHMIDT), A., ii, 375.**
- ψ -Ionone from citral (TIEMANN), A., i, 331.**
- Ions. See Electrochemistry.**
- Iretol, and its triacetyl derivative (KÖHNER), A., i, 224.**
- Iridium sesquichloride (LEIDIÉ), A., ii, 146.**
 estimation of, in alloys of the noble metals (MIETZSCHKE), A., ii, 371.
- Iron in Disko Island, W. Greenland, possible formation of (WINKLER), A., ii, 598.**
 atomic weight of (RICHARDS and BAXTER), A., ii, 407.
 heat of solution of (CAMPBELL), A., ii, 407.
 passivity of (HITTORF), A., ii, 705.
 from the standpoint of the phase rule (ROOZEBOOM), A., ii, 728.
 behaviour of, with hydrogen (HEYN), A., ii, 728.
 function of, in oxidation processes (SARTHOU), A., i, 576.
 amount of, in the hemoglobin of the horse (LAPICQUE and GILARDONI), A., i, 467.
 rôle of, in blood formation (ABDERHALDEN), A., ii, 223, 289, 416; (HOFMANN), A., ii, 491.
 accumulation of, in peat (VAN BEMMELEN, HOITSEMA and KLOBBIE), A., ii, 215.
- Iron alloys with carbon, Osmond and Roberts-Austen's theory of (HEYN), A., ii, 657.**
 with nickel, allotropic transformations of (DUMAS), A., ii, 408.
 estimation of phosphorus in (IBBOTSON and BREARLEY), A., ii, 757.
- Iron salts, hydrolysis of (RICHARDS), A., ii, 472.**
 solubility of, in sucrose solutions (STOLLE), A., i, 333.
 action of sodium thiosulphate on (FAKTOR), A., ii, 692.
- Iron carbonyls, and their importance in the industrial application of water-gas (VAN BREUKELEVEEN and TER HORST), A., ii, 348.**
 pyrophosphate, soluble, test for the purity of (RIDENOUR), A., ii, 444.
 phosphide, preparation of (MARONNEAU), A., ii, 281.
 tungsten phosphide (DEFACQZ), A., ii, 350.
 selenides (FONZES-DIACON), A., ii, 546.
 silicide, Fe_2Si , and its presence in ferro-silicons (LEBEAU), A., ii, 729.
- Ferric chloride, compound of, with nitrosyl chloride (VAN HETEREN), A., ii, 137.**
 action of organic solvents on solutions of (OECHSNER DE CONINCK), A., i, 535.
 fluoride, double salts of, with ferrous, cobalt, nickel, or zinc fluorides (WEINLAND and KÖPFEN), A., ii, 143.
 oxide, ignited, rapid solution of, in hydrochloric acid (BORNTRÄGER), A., ii, 171.
 solution obtained by dialysis (WOBBE), A., ii, 281.
 estimation of, in natural phosphates (VEITCH), A., ii, 577.
 sulphate, basic, $\text{Fe}_2\text{S}_2\text{O}_5$ (SCHARIZER), A., ii, 349.
- Ferrous fluoride, double salts of, with aluminium or ferric fluoride (WEINLAND and KÖPFEN), A., ii, 143.**
 iodide, and its compound with ammonia (JACKSON and DERBY), A., ii, 596.
 syrup of, volumetric valuation of (RUPP), A., ii, 580.
 cadmium sulphates, solubility of (STORTENBEKER), A., ii, 530.
- Iron organic compounds:—**
 Iron compounds, *pentacyano*, preparation and nomenclature of (HOFMANN), A., i, 591.
- Ferrous cyanide, constitution of (BROWNING), T., 1236; P., 1900, 172.**
- Iron ores, estimation of titanium in (BRAKES), A., ii, 248.**
 magnetic, from Eastern Ontario (POPE), A., ii, 409.
 titaniferous, analysis of (BASKERVILLE), A., ii, 629.

Iron ores:—

Steel, tempered and untempered, constitution of; influence of tempering on the state of combination of elements other than carbon (CARNOT and GOUTAL), A., ii, 545.

heat of solution of (CAMPBELL), A., ii, 407.

from the standpoint of the phase rule (ROOZEBOOM), A., ii, 728.

Steel alloys, estimation of phosphorus in (IBBOTSON and BREARLEY), A., ii, 757.

Steel, estimation of carbon in (SARGENT; AUCHY; BLOUNT), A., ii, 574.

estimation of carbon in, treatment of copper potassium chloride for the (SARGENT), A., ii, 440.

estimation of chromium in (DÖHLER; MAHON), A., ii, 110.

estimation of manganese in (NAMIAS), A., ii, 50; (JERVIS), A., ii, 444.

estimation of manganese in, volumetrically (MIGNOT), A., ii, 690.

estimation of molybdenum in (IBBOTSON and BREARLEY), A., ii, 766.

estimation of phosphorus in (IBBOTSON and BREARLEY), A., ii, 757.

containing arsenic, estimation of phosphorus in (CAMP), A., ii, 757.

Iron (in general), estimation and separation of:—

relative values of the Mitscherlich and hydrofluoric acid methods for the estimation of ferrous (HILLEBRAND and STOKES), A., ii, 763.

apparatus for the estimation of (SHIMER), A., ii, 50.

estimation of carbon in (SARGENT; AUCHY; BLOUNT), A., ii, 574.

estimation of graphitic carbon in (FORD and BREGOWSKY), A., ii, 168.

estimation of carbon in, treatment of copper potassium chloride for the (SARGENT), A., ii, 440.

estimation of carbon, copper and manganese in (HERTING), A., ii, 245.

estimation of chromium in (DÖHLER), A., ii, 110.

estimation of manganese in (NAMIAS), A., ii, 50; (HERTING), A., ii, 245.

estimation of manganese in, volumetrically (MIGNOT), A., ii, 690.

estimation of molybdenum in (DÖHLER), A., ii, 691.

containing arsenic, estimation of phosphorus in (CAMP), A., ii, 757.

Iron (in general), estimation and separation of:—

estimation of sulphur in (MOORE), A., ii, 106; (RIEMER), A., ii, 309; (BLOUNT), A., ii, 574.

estimation of, in tap cinder (BLUM), A., ii, 512.

separation of, from chromium, zirconium, and beryllium (HAVENS and WAY), A., ii, 50.

Iron group, molecular susceptibility of salts of the (DU BOIS and LIEBKNECHT), A., ii, 128; (LIEBKNECHT and WILLS), A., ii, 187.

Isatan (BEYERINCK), A., i, 649.

Isatase (BEYERINCK), A., i, 649.

Isatin, action of *o*-phenylenediamine acetate on (MARCHLEWSKI), A., i, 100.

Isatis tinctoria. See Wood.

Isatoic anhydride, formation of (BREED and HOF), A., i, 229.

Isomorphism in Mendeléeff's system (BEHRENS), A., ii, 136.

of salts of ammonium, hydroxylamine, and hydrazine (SABANÉEFF), A., ii, 13.

of red and yellow mercuric oxides (COHEN), A., ii, 184, 381; (OSTWALD), A., ii, 712.

in the aromatic series (OECHSNER DE CONINCK), A., i, 592.

of the formylphenylacetic esters (WISLICENUS), A., i, 597.

in the menthol series (KONDAKOFF and LUTSCHININ), A., i, 104, 604.

space, of the ethers of toluquinone-oxime (MORGAN), A., i, 103.

Isomorphous mixtures and solid solutions (BRUNI), A., ii, 196.

physical equilibrium in (BRUNI and GORNI), A., ii, 197.

of saturated and non-saturated open-chain compounds (BRUNI and GORNI), A., ii, 714.

Isoprene. See Pentinene.

Isotherms and Isochores for systems involving dissociation, deduction of reaction (IKEDA), A., ii, 386.

Ivaarite from Finland (HACKMAN), A., ii, 664.

J.

Jaborandi leaves, alkaloids of (JOWETT), T., 473; P., 1900, 49.

Jaborine (JOWETT), T., 473; P., 1900, 50.

Jadeite from Piedmont (PIOLTI), A., ii, 487.

Japacanine, preparation, composition, properties and salts of (DUNSTAN and READ), T., 58; P., 1899, 207.

Japaconitine, extraction, composition, properties, hydrolysis, salts, and physiological action of (DUNSTAN and READ), T., 47; P., 1899, 206.

Japanic acid (GRITEL and VAN DER WANT), A., i, 271.

Japbensaconine, preparation, properties, hydrolysis and salts of (DUNSTAN and READ), T., 55; P., 1899, 207.

Jasmine, oil of (HESSE), A., i, 48; (WALBAUM), A., i, 509; (JEAN-CARD and SATIE), A., i, 510.

blossom, oil of (HESSE), A., i, 454.

Jasnone, and its oxime and semicarbazone (HESSE), A., i, 48.

Johnstonotite from Tasmania (MACLEOD and WHITE), A., ii, 663.

Jordanite from the Binnenthal (SOLLY and JACKSON), A., ii, 599.

Juniper, empyreumatic oil of (CATHELINEAU and HAUSSER), A., i, 510.

K.

Kaempferia Galanga, oil of (VAN ROMBURGH), A., i, 677.

Kaolinite from Moravia (KOVÁK), A., ii, 148, 149.

from Westanå, Sweden (WEIBULL), A., ii, 286.

Kelyphite from Steinegg, Austria (MRHA), A., ii, 218.

Ketochlorides of aziminobenzene (ZINCKE, STOFFEL, and PETERMANN), A., i, 524.

Ketoprop-cinchonine and -homocinchonine, ethyl ethers of (KOENIG), A., i, 246.

4-Ketodihydroquinazolines, synthesis of (BOGERT and GOTTHELF), A., i, 412, 608.

2-Ketohexamethylenecarboxylic acid. See 2-cyclohexanonecarboxylic acid.

Ketohydrindene, diiodo- (LIEBERMANN and FLATOW), A., i, 667.

Ketohydroxytriphenyltetrahydrobenzene, oxime of, compound of, with certain solvents (PETRENKO-KRITSCHENKO and KASANEZKY), A., i, 350.

Ketolactone, $C_{10}H_{16}O_3$, from isothujone (SEMMLER), A., i, 240.

α -Ketonaphthalene, β -tetrachloro-, phototrophy of (MARCKWALD), A., ii, 2.

Ketone, $C_{10}H_{16}O$, from isofenchyl alcohol (BERTRAM and HELLE), A., i, 399.

$C_{21}H_{40}O$, from heating japanic acid (GRITEL and VAN DER WANT), A., i, 272.

Ketone, $C_{22}H_{40}O_2$, from heating the product of dibenzyl ketone and benzaldehyde (GOLDSCHMIEDT and KNÖPFER), A., i, 36.

$COEt \cdot C_6H_5(OMe) \cdot OPr$, from isoeugenol dibromide and sodium methoxide (POND, MAXWELL, and NORMAN), A., i, 102.

$COEt \cdot C_6H(OMe)_2 \cdot O : CH_2$, from isopiole dibromide and sodium methoxide; and its oxime (POND, MAXWELL, and NORMAN), A., i, 102.

Ketones, formation of, from acid chlorides by means of aluminium chloride (PERRIER), A., i, 331; (BOESEKEN), A., i, 349.

from the dibromides of propenyl compounds, and of unsaturated ketones (POND, MAXWELL, and NORMAN), A., i, 102.

new synthesis of (WEDEKIND), A., i, 665.

electro-synthesis of (HOFER), A., i, 275.

condensation products of, with α -aldehydic acids, properties of (FULDA), A., i, 36.

alkylation of (NEF), A., i, 349.

reactions of, with alkyl nitrites, in presence of excess of alcoholic hydrogen chloride (KISSEL), A., i, 620.

action of Caro's reagent on (v. BÄYER and VILLIGER), A., i, 133, 206, 328, 627.

action of ethyl cyanoacetate and ammonia on (GUARESCHI and GRANDE), A., i, 111; (MINOZZI), A., i, 407.

of the type $CO(CH:CHR)_2$, action of hydroxylamine hydrochloride on, in presence of sodium acetate (MINUNNI and CARTA-SATTA), A., i, 237.

condensation of, with nitromalonaldehyde (HILL, SOCH, and OENSLAGER), A., i, 538.

conversion of, into α -diketones (PONZIO), A., i, 588.

cyclic, ring disruption among (WALLACE), A., i, 44, 589.

condensation of, with ethyl succinate (STOBBE and FISCHER), A., i, 179.

isomeric, separation of (MICHAEL), A., i, 321.

amino-, formation of alkali salts of (WILLSTÄTTER and BODE), A., i, 245.

aromatic, new method of preparing (KUNCKELL), A., i, 664.

halogenised (KUNCKELL), A., i, 663.

Ketones, dichloro-, formation of, by the action of hypochlorous and hypobromous acids on acetylene and its mono-substituted derivatives (WITTORF), A., i, 421.

Ketones and Quinones. See also :—

Acetone.
Acetonechloroform.
Acetonylacetone.
Acetophenone.
Acetophenoneazobilirubin.
Acetophenonephenylacetylene.
Acetoxymesityl oxide.
Acetylacetanilide.
Acetylaceto- ψ -cumidide.
Acetylacetone.
Acetylacetotoluidides.
Acetyl-*as*-aceto-*m*-xylylide.
Acetylaminacetophenone.
Acetyl amino-4-anilino- β -naphthaquinone.
4-*p*-Acetylaminobenzeneazo-1-phenyl-3-methylpyrazolone.
p-Acetylaminobenzoylcarbinol.
7-Acetyl amino- β -naphthaquinone.
Acetylcarbinol.
1-Acetylcoumarone.
Acetyl- ψ -cumidine.
Acetyl methylcyclohexanone.
Acetylphenylacetylene.
Acetylpyrrolidone.
Acetyltoluidines.
Acetyl-*as*-*m*-xylylide.
Allylacetone.
*iso*Amyloxyacetone.
Anhydroacetylacetoneaminocamphor.
Anhydrobenzoylacetoneaminocamphor.
Anhydroethylacetacetateaminocamphor.
Anhydrotrisdiketohydrindene.
Anilindiphenylbenzoquinone.
3-Anilino-1-indone.
Anisoin.
Anthragallol.
Anthraphenones.
Antipyrine.
Apigenin.
Benzaldehydepyrrolylhydrazone.
Benzeneazobenzoylacetone.
3-Benzeneazo-6-hydroxybenzylideneacetophenone.
Benzil.
Benzoin.
Benzophenone.
Benzophenone diethyl, diphenyl, and ditolyl diketones.
Benzophenonediphenyldiketonedicarboxylic acid.
Benzophenonephenylacetylene.
Benzoxo- γ -pyrone.
Benzoylacetone.
Benzoylanisoylmethane.

Ketones and Quinones. See :—

Benzoylbenzhydrol.
Benzoylcarbinol.
Benzoylphenylacetylene.
 α -Benzoylphenylhydrazinotrichloroquinone.
Benzoyl-2:4:6:4'-tetramethoxyacetophenone.
Benzylaminochloroindone.
8-Benzylamino-1-indone.
Benzylidenebisacetylacetones.
Benzylidenebisgallacetophenone.
Benzylidenebisresacetophenone.
Benzyl- α -naphthaquinone.
p-Bis-1-phenyl-3-methylpyrazolone-azobenzene.
Bispulegone.
4-*tert*. Butylcoumarone.
*iso*Butylideneacetone.
Butylxylyl methyl ketone.
*iso*Butylalacetone.
p-n-Butylacetanilide.
p-n-Butylylaniline.
*iso*Camphenone.
Camphenylone.
Camphor.
Camphorone.
Carbindigo.
Carvenone.
Carvone.
Carvotanacetone.
Chromone (*pheno- γ -pyrone*).
Chrysarobin.
Chrysoketone.
Chrysophanic acid.
Chrysophanohydroanthrone.
Chrysoquinone.
Coumarone.
Cotoin.
Decahydroacridinedione.
Deoxybenzoin.
Desylacetomesitone.
Desylacetoneaphthones.
Diacetoneamine.
Diacetoneguanidine.
Diacetoxystilbene.
Diacetylacetone.
Dianilinophenylbenzoquinone.
Dibenzoxystilbene.
Dibenzoylmethane.
Dibenzyl ketone.
Dibenzylacetophenone.
Dicotoin.
Dicoumaryl ketone.
Diethoxyacetylacetophenones.
Diethoxybenzoylacetophenones.
3:7-Diethoxychromone.
Diethoxyflavanones.
Diethoxyflavones.
Diethylaminoanthraquinone.
Dihydrocarvone.
Dihydroeucarvone.

Ketones and Quinones. See :—

Dihydroxyflavanones.
 Dihydroxyflavones.
 Dihydroxy-*m*-xyloquinone.
 Diindoneacetone.
 Diindoneacetophenone.
 Diindonebenzoylacetone.
 Diketobutyrolactone.
 1:3-Diketohydrindene.
 2:5-Diketotetrahydrothiazole.
 2:3-Dimethoxyphenanthraquinone.
 Dimethylaminoanthraquinone.
 6-Dimethylamino-8-methylcoumarone.
o-Dimethylanthraquinone.
 Dimethyldiacetylacetone.
 Dimethylcoumarones.
 Dimethylphenomorpholone.
 Dimethylpyrone.
 Diphenylbenzoquinone.
 Diphenyldiketopiperazine.
 Diphenylmethane diphenyl and ditolyl diketones.
 1:2-Diphenyl-4-phenacylpyrrolone.
 Diphenyloctohydroxanthenedione.
 Diphenylpyrimidone.
 Diphenylquinone.
 1:2-Diphenyltetrahydro- β -naphthenone.
 Diisopropyl diketone.
 Dypnone.
 4'-Ethoxyflavone.
 7-Ethoxy-2-methylchromone.
 2-Ethoxy-3:4'-methylenedioxy-flavone and -flavone.
 Ethoxyphenylthiodiazolone.
 3-Ethoxy-1-phenyl-5-triazolone.
 Ethylaminoindone.
 Ethylchlorophenomorpholone.
 Ethylcoumarones.
 Ethyldiacetylacetone.
 2-Ethyl-4-ketodihydroquinazoline.
 Ethylpyrrolidone.
 1-Ethyl-2-quinolone.
 Fenchocamphorone.
 Fenchone.
 Flavone.
 Genistein.
 Hexamethyloctohydroxanthenedione.
 α -Hydroxybenzylideneacetophenone.
 2-Hydroxy-3:4'-diethoxychalkone.
 1-Hydroxy-3:4'-diethoxyflavone.
 1-Hydroxy-3:4'-dimethoxyflavone.
 8-Hydroxy-5:7-dimethylfluorone.
 3'-Hydroxy-8-ethoxyflavone.
 4'-Hydroxyflavone.
 6-Hydroxy-4-furfuryl-4-*p*-methoxyphenyl- and -4-phenyl- $\Delta^{3,6}$ -dihydropyridone.
 Hydroxylepidone.
 4-*p*-Hydroxy-*m*-methoxybenzylidenebis-1-phenyl-3-methyl-5-pyrazolone.

Ketones and Quinones. See :—

3-Hydroxy-5-methoxy-2-methyl-*p*-quinone.
 Hydroxymethylchromones.
 Hydroxymethylenetropinone.
 8-Hydroxymethylfluorone.
 Hydroxynaphthaquinone.
 3-Hydroxypiperidone.
 Hydroxystyrogallol.
p-Hydroxytoluquinone.
 Indone.
 Ionone.
 ψ -Ionone.
 Jasmone.
 Ketoapocinchenine.
 Ketodihydroquinazoline.
 Ketoapohomocinchenine.
 Ketohydrindene.
 α -Ketonaphthalene.
 Luteolin.
 2:6-Lutidyl acetonyl sulphide.
 Meconindimethyl ketone.
 Menthone.
 α -Mesityne.
 Mesityl oxide.
 2-Methoxyacetylacetophenone.
 4-Methoxyanthraquinone.
 Methoxycoumarones.
 3'-Methoxy-2:4'-diethoxy-flavone and -flavone.
 Methoxy mesityl oxide.
 Methoxyphenanthraquinones.
 Methylacetylcarbinol.
 Methylalizarin.
 Methylaminomethyl-2-piperidone.
 β -Methylanthraquinone.
 Methyl isobutenyl ketone.
 2-Methylchromone.
 Methylcoumarones.
 Methylenehydrosulphine salts.
 Methyl ethyl ketone.
 Methylenehyphenacylsulphine salts.
 Methyl furfuryl ketone.
 Methyl-2-heptene-4-one-6.
 Methylcyclohexamethylene ketone.
 Methylcyclohexanone.
 Methylhystazarin.
 2-Methyl-4-ketodihydroquinazoline.
 Methylcyclopentanone.
 Methylphenomorpholone.
 5-Methylphenoxazine-2:3-quinone.
 Methylisopropylcoumarones.
 Methyl propyl ketone.
 Methylquinizarin.
 Naphtha- β -ketopentamethyleneazine.
 Naphthantraquinone.
 Naphthapurpurin.
 Naphthaquinoneacetylacetones.
 Naphthaquinonebenzoylacetones.
 Naphthaquinonebis-1-phenyl-3-methylpyrazolone.
 β -Naphthaquinone-4-deoxybenzo-

Ketones and Quinones. See:—

a-Naphthaquinone-3-dihydro-resorcinol.
 Naphthaquinones.
 Naphthazarin.
β-Naphthoxyacetone.
 Nopinone.
 Octohydroacridinedione.
 Octohydroxanthenedione.
a-Oximino-ketones.
 Oxymethylenecamphor.
ββ-Oxy-*β*-methyl-*η*-octene-*ε*-one.
 Pentahydroxynaphthaquinone.
 Pentamethylketohydroxanthenedione.
 Phenanthraquinone.
 Phenoketopentamethyleneazine.
 Pheno-*γ*-pyrone.
 Phenoxycetophenone.
 Phenylaminopyridothiazinone.
 1-Phenyl-3-benzoyloxydiazolone.
 Phenyldecahydroacridinedione.
 Phenyl diazopyridothiazinone.
 1-Phenyl-2:5-diketotetrahydrothiazole.
 1-Phenyl-3:8-dimethyl-2-indolinone.
 1-Phenyldimethylpyrazolone.
 Phenylene ditolyl diketone.
 1-Phenyl-4-*o*-ethoxybenzylidene-3-methyl-5-pyrazolone.
 1-Phenyl-3-ethyl-5-ketotriazole-4-carbamide.
 1-Phenyl-3-furfurylpyrazolone.
 1-Phenyl-4-*p*-hydroxy-4-methoxybenzylidene-3-methyl-5-pyrazolone.
 2-Phenylketonaphthatriazine.
 1-Phenyl-4-ketopyrazoline.
 1-Phenyl-4-ketopyrazolone.
 1-Phenyl-5-ketotriazole-4-carbamide.
 Phenylketotriazoles.
 Phenyl meconinmethyl ketone.
 5:3-Phenylmethyl- Δ^2 -cyclohexenone.
 1-Phenyl-3-methyl-5-ketotriazole-4-carbamide.
 Phenylmethylpyrazolones.
 3-(or 5)-Phenyl-4-*p*-nitrobenzeneazo-5-(or 3)-methylisooxazolone and-pyrazolone.
 Phenylloctohydroxanthenedione.
 5-Phenylisooxazolone.
 Phenyl phthalidemethyl ketone.
 2-Phenylquinone.
 Phenyltetramethyloctohydroxanthenedione.
 Phorone.
 Propionylaceto-*ψ*-cumidide.
 Propionylaceto-*o*-toluidides.
 Propionylacetoxylidide.
 Phthalididemethyl ketone.
 Phthalylimino-ketones.
 Pinacolin.
 Pinenone.
 Piperidylacetophenones.

Ketones and Quinones. See:—

Piperonylaceton.
 Piperonylideneecamphor.
p-Propionylacetanilide.
p-Propionylaniline.
 Propionylcarbinol.
p-Propionylphenylcarbamide.
 Propyl butyl ketones.
 4-*iso*Propylcoumarone.
*iso*Propylpyrrolidone.
 Pulegones.
 Pyramidone.
 Pyridineacetophenone.
 Pyrrolidone.
 Pyrrolylazoimide.
 Pyrrolylhydrazide.
 2 Quinolones.
 Quinone.
 Rhabarberohydroanthrone.
 Rhabarberone.
 Sabinene ketone.
 Santalone.
 Succitoyl ketone.
 Tanacetone.
 Terpenone.
 Tetrahydropropyrene.
 Tetrahydroxyanthraquinone.
 2:4:6:4'-Tetramethoxybenzoylacetophenone.
 Tetramethyldiaminobenzophenone.
s-Tetramethylbenzoin.
 1:3:4:6-Tetramethylcoumarone.
 Tetramethyldecahydroacridinedione.
 Tetramethyldihydropyridone.
 Tetramethylethylloctohydroxanthenedione.
 Tetramethyloctohydroxanthenedione.
 Tetramethylpyridone.
 Tetramethylpyrone.
 Tetraphenyl-*ββ*-diketopiperazine.
 Tetraphenylpyrrolone.
 Thujamenthone.
*iso*Thujone.
 Toluquinone.
 2-Tolylketo-7-methylphenotriazine.
 Tolyloxycetones.
 Tolylypyridazinone.
p-Tolylypyrrolidone.
 Triacetonedibenzamidine.
 1:3:4'-Triacetoxylflavone (*triacetylapi-grin*).
 Trihydroxyanthracoumarin.
 1:3:4'-Trihydroxyflavone (*apigenin*).
 2:3:4'-Trihydroxyflavone.
 Trihydroxynaphthaquinones.
 1:3:4-Trimethoxyflavone.
 Trimethylcoumarones.
 Trimethyldihydropyridone.
 Trimethylcyclopentanone.
 4:5:6-Trimethylpyridone.
 Trimethylpyrone.
 Triphenyldecahydroacridinedione.

Ketones and Quinones. See:—

Triphenyloctohydroxanthenedione.

Trisdihydroxybenzoylenebenzene.

Trisdiketohydrindene.

Tropinone.

Verbenone.

Xanthone.

Xylenoxyacetone.

Ketonic acid, $C_{10}H_{18}O_3$, from β -dimethyloctane- ϵ -oleic acid (v. BAER), A., i, 182.**Ketonic acids** from disulphones (POSNER and FAHRENHORST), A., i, 16.

condensation of, with nitromalonaldehyde (HILL, SOCH, and OENSLAGER), A., i, 538.

mercaptols and disulphones of (POSNER), A., i, 5.

mercury salts of (LEY), A., i, 382.

 γ -Ketonic acids, action of phenylcarbimide and aniline on (KLOBB), A., i, 405.**2-Ketopentamethylenecarboxylic acid.** See 2-cyclopentanonecarboxylic acid.**2-Ketophenemorpholine-4-, -5- and -6-carboxylic acids**, and their methyl esters and amides (EINHORN and OPPENHEIMER), A., i, 494.**Ketoximes** (PETRENKO-KRITSCHENKO and KASANEZKY), A., i, 350.

electrolytic oxidation of (SCHMIDT), A., i, 382.

Kidneys, action of certain poisons on the (LINDEMANN), A., ii, 492.**Kieselguhr** from Co. Antrim (POLLOK), A., ii, 287.**Kossin** and the other constituents of *Flores Kosso* (KONDAKOFF; KONDAKOFF and SCHATZ), A., ii, 38.**Kohl-rabi.** See Agricultural Chemistry.**Krypton** (LADENBURG and KRÜGEL), A., ii, 540, 723.**L.****Labdanum resin**, examination of (DIETERICH), A., ii, 118.**Labradorite** from Russia (TARASSENKO), A., ii, 26.**Lactase** of the pancreas (WEINLAND), A., ii, 93.**Lactation**, influence of phloridzin diabetes on (LUSK), A., ii, 558.**Lactic acid** (i-ethylidenelactic acid, α -hydroxypropionic acid), occurrence of, in the organism, in arsenical poisoning (MORISHIMA), A., ii, 296.
oxidation of, in presence of ferrous salts (FENTON and JONES), T., 71; P., 1899, 224.**Lactic acid**, reduction of metallic nitrates by (VANINO and HAUSER), A., ii, 722.

salts of, and lactide, thermochemical data for (BERTHELOT and DELEPINE), A., ii, 180.

estimation of, in the commercial article (JEAN), A., ii, 767.

separation of butyric and valeric acids and (SCHNEIDER), A., ii, 177.

Lactic acid bacillus. See Bacillus.**Lactone**, $C_{10}H_{18}O_2$, from the bromination of homocamphoric acid (LAPWORTH), T., 1063; P., 1900, 128.

from ethyl fumarate and benzyl cyanide (HENZE), A., i, 347.

(b. p. 234-236°), from heating β -hydroxy- α,α -trimethyladipic acid (BLAISE), A., i, 330.**Lactones**, action of ammonia on (MEYER), A., i, 9.

action of hydrazine hydrate on (WEDEL), A., i, 363.

Lactones. See also:— ψ -Campholactone.

Campholide.

Camphonolactone.

Catechobis- α -oxy-butyric, -propionic, and -isovaleric acids, lactones of.

Coumarin.

Dehydracetic acid.

7-Diethylamino-4-methylcoumarin.

Dihydroxybutanetetracarboxylic acid, lactone of.

Diketobutyrolactone.

7-Dimethylamino-4-methylcoumarin.

7-Dimethylamino-4-methyl-3-ethylcoumarin.

 β -Dimethyloctane- ϵ -olide.Diphenacylacetic acid, γ -lactone of.Homocamphanic acid (lactone of α -hydroxyhomocamphoric acid).

Hydroxyapocinchonic lactone.

2-Hydroxy- β -dimethyloctic acid, lactone of.

2-Hydroxy-1-naphthylacetic acid lactone of.

Hydroxyphenylacetic acid, lactone of.

Ketolactone, $C_{10}H_{18}O_2$.

7-Methylamino-4-methylcoumarin.

4-Methylcoumarin.

Methylenemannonic lactones.

isoOctolactone.

 β -Oximinobutyrolactone.

4-Phenylcoumarin.

Pinodihydrocampholenolactone.

 β -isoPropylheptane- ϵ -oleic acid, lactone of.

Strophanthidolactone.

Tetramethyl-6:7-dihydroquino-coumarin.

Trihydroxybutyric acid, lactone of.

- Lactones.** See :—
 Triphenylcrotonolactone.
 Xylonic lactone.
- Lactopheninsulphonic acid** (COHN), A., ii, 29.
- Lactose** (*milk sugar*), formation of, in the organism (MOORE and PARKER), A., ii, 671
 degradation of (RUFF and OLLEN-DORFF), A., i, 476.
 detection of sucrose in (LANDIN), A., ii, 514.
 estimation of, in milk (GALLIEN), A., ii, 324.
- Lævulinic acid** (*β -acetylpropionic acid*), mercury derivatives of (LEY), A., i, 382.
p-nitrophenylhydrazones of (FEIST), A., i, 569.
- Lävulomannan** from *Phytelephas macrocarpa*, and its dibenzoyl derivative (BAKER and POPP), T., 696; P., 1900, 72.
- Lävulose** (*fructose*) in beet leaves (LINDET), A., ii, 302.
 oxidation of, and compounds of, with the haloid salts of the alkaline earths (SMITH and TOLLENS), A., i, 378.
- Lamps** for spectra (BECKMANN), A., ii, 701.
- Langbeinite** from the Punjab (MALLET), A., ii, 22.
- Lapodin** from *Rumex palustris* and *R. obtusifolius* (HESSE), A., i, 41.
- Lard** and its substitutes, relative digestibility of, in the human intestine (LÜHRIG), A., ii, 355, 667.
- Larderellite** from the suffioni of Tuscany (D'ACHIARDI), A., ii, 600.
- Laricinolic and α - and β -Larinolic acids** (TSCHIRCH and WEIGEL), A., i, 680.
- Lariciresinol**, dry distillation of (BAMBERGER and VISCHNER), A., i, 605.
- iso*Lariciresinol, preparation, and tetraacetyl and dimethoxy derivatives of, and its isomeride (BAMBERGER and LANDSTEDL), A., i, 48.
- Larix decidua**, balsam of (TSCHIRCH and WEIGEL), A., i, 680.
- Lasur-oligoelase** from Lake Baikal (V. JEREMÉEFF), A., ii, 603.
- Latent image.** See Photochemistry.
- Laudanosine** (*d-N-methyltetrahydro-papaverine*) and its salts (PICTET and ATHANASESCU), A., i, 685.
- Laumontite** from Petersberg, near Halle (LUEDECKE), A., ii, 218.
- iso*Lauronic acid, constitution of (BLANC), A., i, 329.
- iso*Lauronolic acid (LEES and PERKIN), P., 1900, 18.
- iso*Lauronolic acid, constitution of (NOYES), A., i, 202; (BLANC), A., i, 581, 586.
 and its stereoisomeride, reactions and structure of (WALKER and CORMACK), T., 374; P., 1900, 58.
- Lavender**, development of terpenes in (CHARABOT), A., i, 241.
 oil of (JEANCARD and SATIE), A., i, 510.
- Law** of Cailletet and Mathias, and the critical density (YOUNG), A., ii, 711.
 of multiple proportions, lecture experiment on the (EMICH and DÖRNER), A., ii, 340.
- Lead**, sensitiveness of, to light (WATERHOUSE), A., ii, 585.
 equilibrium between zinc and, and mixtures of their fused chlorides (REINDERS), A., ii, 715.
- Lead compounds** with sodium, composition and melting point of (KURNAKOFF), A., ii, 277.
 analyses of (MENNIOKE), A., ii, 688, 761.
- Lead salts**, action of sodium thiosulphate on (FAKTOR), A., ii, 688, 691.
- Lead chlorate**, decomposition of (SODÉAU), T., 717; P., 1900, 88.
 tetrachloride and its double salts with amines (MEYER and BEST), A., ii, 78.
 dioxide, change of resistance of (SUNDORPH), A., ii, 5.
 triplumbic tetroxide (*minium*), estimation of (TOCHER), A., ii, 442.
- peroxide**, action of hydrogen sulphide on (VANINO and HAUSER), A., ii, 279.
 "peroxide" (KASSNER), A., ii, 725.
 selenides and chloroselenides (FONZES-DIAON), A., ii, 402.
 sulpharsenites. See Jordanite, Rathite, and Sartorite.
 polysulphide (BODROUX), A., ii, 480.
 thioantimonite and its double salt with potassium (POUGET), A., ii, 84.
- Lead organic compound** :—
 ferrocyanide (MILLER and FISHER), A., ii, 761.
- Lead, estimation and separation of** :—
 dry assay of (FLATH), A., ii, 512.
 electrolytic estimation of, in the sulphate and chromate, and in lead glass (MARIE), A., ii, 368.
 estimation of, in zinc (MACKAY), A., ii, 49.
 separation of, from bismuth (CLARK), A., ii, 371.
- Leather**, specific heat of (FLEURY), A., ii, 188.

- Leather**, analysis of (FAHRION), A., ii, 59.
- Lecithin**, preparation of (BERGELL), A., i, 621.
- Lees**, polarimetric estimation of sugars in (PELLER), A., ii, 113.
- Leguminosæ**. See Agricultural Chemistry.
- Lekene** from the wax of Bacillariaceæ (KRAEMER and SPILKER), A., i, 73.
- Lemon**, oil of, properties of (SOLDAINI and BERTÉ), A., ii, 173.
valuation of (WALTHER), A., ii, 173.
flavouring extracts and its substitutes, valuation of (MITCHELL), A., ii, 174.
- Lemonade essences**, testing (WENDER and GREGOR), A., ii, 767.
- Lentil seedlings**, proteolytic ferment of (HARLAY), A., ii, 744.
- Lepidium sativum**, constituents of (GADAMER), A., i, 49.
- Lepidolite**, cæsium and rubidium salts from (FORMÁNEK), A., ii, 15.
- 2-Lepidyl-hydrasine**, -phenylthiosemicarbaside, and -semicarbaside (MARCKWALD and CHAIN), A., i, 521.
- Lettuce**. See Agricultural Chemistry.
- Leucæmia**, metabolism in (v. STEJSKAL and ERBEN), A., ii, 423.
- Leucine**, derivatives of (FISCHER), A., i, 647.
- L-Leucine** (WALLACH), A., i, 590.
- Leucinimide**, constitution of, and base $C_{12}H_{28}N_2$, from (COHN), A., i, 466.
- Leucite**, action of ammonium chloride on (CLARKE and STEIGER), A., ii, 219.
- Leuco-base**, $C_{18}H_{24}N_2$, action of nitrous acid on (TRILLAT), A., i, 192.
- Leucocytes**, rôle of, in poisoning by arsenic (BESREDEKA), A., ii, 156.
decomposition products of histon from (LAWROFF), A., i, 71.
- Leucomethylene-blue**, acyl derivatives of (COHN), A., i, 455.
- Leucophanite** from New Jersey (PENFIELD and WARREN), A., ii, 89.
- Leucosphenite** from Greenland (FLINK), A., ii, 411.
- Leucotoxin** (BESREDEKA), A., ii, 741.
- Leverrierite** from Rochebelle, Gard (TERMIER), A., ii, 86.
- Libollite** from Portuguese West Africa (GOMES), A., ii, 86.
- Light**, polarised, method of showing the properties of (UMOFF), A., ii, 181.
influence of, on the respiration of lower Fungi (KOLKOWITZ), A., ii, 861.
effect of, filtered through leaves, on chlorophyll assimilation (GRIFFON), A., ii, 159.
- Light**, influence of, on the production of proteids in plants (PALLADIN), A., ii, 612.
See also Photochemistry.
- Lime**. See Calcium oxide, and Agricultural Chemistry.
- Limestone**, estimation of calcium in, photometrically (HINDS), A., ii, 575.
- Limestones** from Moravia (KOVÁK), A., ii, 147, 148.
- d-Limonene** from carvone (TSCHUGAEFF), A., i, 352.
- Limonenes**, ψ - and σ -, formulæ of (SEMMIER), A., i, 453.
- Limonite** from Moravia (KOVÁK), A., ii, 148.
pseudomorphs from Dutch Guiana (RAYMOND), A., ii, 86.
- Linalool-group**, metamorphoses and migrations of compounds of the, in plants (CHARABOT), A., i, 241; ii, 101, 361, 862.
- Linseed oil**, analysis of (McILHINEY), A., ii, 633.
- Liparite** from Sumatra (MILCH), A., ii, 150.
- Liquefaction** of a gas by "self-cooling" (NEWTN), P., 1900, 87.
of gaseous mixtures (CAUBET), A., ii, 191, 390, 646.
- Liquids**, absorption spectra of, in the ultra-red (PUCCIANTI), A., ii, 585.
transparency of, to electric oscillations (DE HEEN), A., ii, 524.
equation of condition for; determination of the constants a and b of van der Waal's equation (GUYE and FRIDERICH), A., ii, 709.
van't Hoff's equation and molecular weights of (SPRYERS), A., ii, 10.
molecular association in (BERTHELOT), A., ii, 335, 337.
minimum volume of (GULDBERG), A., ii, 264; (BERTHELOT), A., ii, 335.
supercooled, velocity of solidification and viscosity of (WILSON), A., ii, 712.
organic, surface tension of (DUTOIT and FRIDERICH), A., ii, 194.
flocculation of (SPRING), A., ii, 713.
reciprocal solubility of (BRUNI), A., ii, 196.
fermented, estimation of succinic acid in (LABORDE and MOREAU), A., ii, 114.
- Liquorice extract**, estimation of glycyrrhizin in (HAFNER), A., ii, 328, 775.
pastes, analysis of (TRUEBECK), A., ii, 378.
- Lithium** in plants (TSCHERMAK), A., ii, 235.

Lithium, preparation of metallic (KAHLENBERG), A., ii, 206.
 melting point of (KAHLBAUM), A., ii, 277.
Lithium amalgam (KEPP and BÖTTGER), A., ii, 656.
Lithium aluminates (ALLEN and ROGERS), A., ii, 727.
 antimonide, arsenide, bismuthide, and stannide (LEBEAU), A., ii, 276.
 bromide and iodide, temperature of maximum density of solutions of (DE COPPET), A., ii, 529.
 compounds of, with gaseous ammonia (BONNEFOI), A., ii, 478.
 chloride and nitrate, electrical conductivity of solutions of (KOHLEBAUSCH and MALTEY), A., ii, 61.
 compounds of, with ethylamine (BONNEFOI), A., ii, 130.
 peroxide and its hydrate, thermochemistry of (DE FORCRAND), A., ii, 478.
 thioantimonites and double salts with silver (POUGET), A., ii, 84.
Lithium-tungsten bronze (STAVENHAGEN), A., ii, 80.
Liver, aldehyde from the (JACOBY), A., i, 711.
 constituents of the, which form sugars (SEEGEN), A., ii, 29.
 formation of ammonia in the, and changes in the, during phosphorus-poisoning (JACOBY), A., ii, 671.
 urea in the (GOTTLIEB), A., ii, 29.
 results of the extirpation of, in dogs (SALASKIN and ZALESKI), A., ii, 607.
Liver extracts, action of, on salicylaldehyde (MEDVEDEFF), A., ii, 738.
Liverworts, chemistry of the cell membranes of (CZAPEK), A., i, 556.
Löllingite from the Harz (SCHEIBE), A., ii, 661.
Lorenzenite from Greenland (FLINK), A., ii, 411.
Lotus corniculatus. See Agricultural Chemistry.
Lucerne. See Agricultural Chemistry.
Lucerne seeds, carbohydrates in (BOURQUELOT and HÉRISSEY), A., ii, 301.
 enzyme of (BOURQUELOT and HÉRISSEY), A., ii, 233.
Luminescence of ring compounds (KAUFFMANN), A., i, 480.
Luminosity of 1-ethyl-2-quinolone (DECKER), A., i, 688.
2:4-Lupetidine. See 2:4-Dimethylpiperidine.
Lupins. See Agricultural Chemistry.
Lupinus albus. See Agricultural Chemistry.

Luteolin, constitution and dimethyl ether of (PERKIN), P., 1899, 242.
 and its methyl ethers, decomposition products and salts of (PERKIN and HORSFALL), T., 1814; P., 1900, 181.
 methyl ether, and its triacetyl and tribenzoyl derivatives (VONGERICHTEN), A., i, 681.
Lutidine. See 2:6-Dimethylpyridine.
Lutidine (b. p. 148°-156°), from methylcyclohexanoneoxime (WALLACH), A., i, 45.
Lutidinedicarboxylic acid. See 2:6-Dimethylpyridine:3:5-dicarboxylic acid.
2:6-Lutidyl-. See 2:6-Dimethylpyridyl-.
2:4-Lutidylalkine. See 2-Hydroxyethyl-4-methylpyridine.
Lymph, properties and formation of (ASHER and GIES), A., ii, 673.
 influence of protoplasmic poisons on the formation of (GIES and ASHER), A., ii, 291.
 proteids of, action of lymphagogues on (TIMOFÉEFFSKY), A., ii, 95.
Lysine (HENDERSON), A., i, 571.
 from the proteid of conifer seeds (SCHULZE and WINTERSTEIN), A., ii, 101.
 from the proteid of *Lupinus luteus* seedlings (SCHULZE), A., ii, 101.
 constitution of (ELLINGER), A., i, 143; (HENDERSON), A., i, 571.
d-Lyxose and its phenylbenzylhydrazone (RUFF and OLLENDORFF), A., i, 476.
 action of hydrocyanic acid on (FISCHER and RUFF), A., i, 539.

M.

Macassar oil (WILS), A., ii, 252.
Macleynine. See Protopine.
Magenta, action of sodium hydroxide on (HANTZSCH), A., i, 365.
 compounds of, with acidic colouring matters, composition of (SEYEWETZ), A., i, 522.
 compounds of, with acidic colouring matters having a basic chromophore (SEYEWETZ), A., i, 645.
 compounds of, with sulpho-azo-colouring matters (SEYEWETZ), A., i, 614.
Magnesium, action of, on saline solutions (TOMMASI), A., ii, 16; (MOURAOUR), A., ii, 206.
 action of metallic, on water (BRYANT), A., ii, 278.
 metabolism of (LEIPZIGER), A., ii, 223.

- Magnesium alloy** with platinum (HODGKINSON, WARING, and DESBOROUGH), A., ii, 282.
- Magnesium salts**, influence of ammonia on (SCHIEBER), A., ii, 345.
- Magnesium ammonium arsenate** (ARSTIN), A., ii, 245.
- orthoborate* (OUVRARD), A., ii, 206.
- bromide, electrolysis of solutions of (SARGHEL), A., ii, 401.
- carbonate, anhydrous (ENGEL), A., ii, 17.
- ammonium phosphate, composition of (NEUBAUER; GOOCH and AUSTIN), A., ii, 108.
- potassium sulphate, hydrate of (VAN'T HOFF and KASSATKIN), A., ii, 284.
- potassium and magnesium rubidium sulphates (MALLET), T., 219, 223; P., 1899, 227.
- Magnesium new organo-metallic compounds** (BRIGNARD), A., i, 382.
- Magnesium, estimation of:**—
estimation of, volumetrically (MEADE), A., ii, 48; (HANDY), A., ii, 314.
- Magnetic behaviour of alcohols** (HEINRICH), A., ii, 707.
- of aromatic hydrocarbons (FREITAG), A., ii, 708.
- field, action of the, on Becquerel rays, and on rays from polonium and radium (CURIE), A., ii, 126.
- effect of the, on radium radiations (BECQUEREL), A., ii, 182, 183.
- influence of the, on rays from radioactive substances (BECQUEREL), A., ii, 126.
- pyrites. See Pyrrhotite.
- rotation. See Photochemistry.
- susceptibility, determination of some coefficients of (MEYER), A., ii, 385.
- of inorganic compounds (MEYER), A., ii, 7; (KÖNIGSBERGER), A., ii, 258.
- Magnetism**, atomic and molecular (MEYER), A., ii, 7, 385; (LANG), A., ii, 707.
- influence of, on chemical reactions (DE HEMPTINNE), A., ii, 707.
- molecular, of salts of the rare earths (DU BOIS and LIEBKNECHT), A., ii, 127, 333; (MEYER), A., ii, 186.
- of salts of the iron group (DU BOIS and LIEBKNECHT), A., ii, 128; (LIEBKNECHT and WILLS), A., ii, 187.
- Magnetite** from near Rome (ZAMBINI), A., ii, 147.
- Magnetites**, titaniferous (KEMP), A., ii, 283.
- Magnus' salt** (JÜRGENSEN), A., i, 542; (BILLMANN), A., i, 543.
- Maize and Maize gluten.** See Agricultural Chemistry.
- Maize oil** (*corn oil*), constants of (WILLIAMS), A., ii, 582.
- physical and chemical constants of (VULTE and GIBSON), A., ii, 697.
- adulteration of cotton seed oil with (MORPURGO and GÜTEL), A., ii, 377.
- Malic acid** from *Hippophaë rhamnoides* (ERDMANN), A., i, 135.
- optical rotation of, in the pure state and in solution (WALDEN), A., i, 11.
- oxidation of, in presence of ferrous salts (FENTON and JONES), T., 75; P., 1899, 224.
- oxidation of, by potassium permanganate (DENIGES), A., i, 204.
- estimation of (HILGER), A., ii, 768.
- estimation of, in tartar and grapes (ORDONNEAU), A., ii, 250.
- Malic acid**, beryllium alkali salts of (ROSENHEIM and ITZIG), A., i, 135.
- molybdo- and tungsto-alkali salts of, specific rotatory power of (ROSENHEIM and ITZIG), A., i, 272.
- l*-Malic acid, action of heat on (WALDEN), A., i, 10.
- Malic acids**, α - and β -, and their salts (ORDONNEAU), A., i, 203.
- Malonaldehyde**, nitro-, condensation of, with ketones and ketonic acids (HILL, SOCH, and OENSLAGER), A., i, 538.
- Malonamide**, action of nitrosyl chloride on, and of hydroxylamine on its dibromo-derivative (WHITELEY), T., 1040; P., 1900, 145.
- Malonic acid**, condensation of, with dibromo- α -naphthaquinone (LIEBERMANN), A., i, 310.
- action of iodine on a pyridine solution of (ORTOLEVA), A., i, 558.
- α -semi-aldehyde of (WOHL and EMMERICH), A., i, 627.
- Malonic acid**, ethyl ester, action of bromine and carbon disulphide on the sodium derivative of (WENZEL), A., i, 536.
- condensation of, with formaldehyde (BOTTOMLEY and PERKIN), T., 294; P., 1900, 16.
- condensation of the sodium derivative of, with ethyl $\alpha\alpha'$ -dibromo- $\beta\beta$ -dimethylglutarate (PERKIN, THORPE, and WALKER), P., 1900, 149.
- action of dry silver oxide and ethyl iodide on (LANDER), T., 743; P., 1900, 6, 90.
- Malt**, nitrogenous substances in (PETIT and LABOURASSE), A., ii, 680.

- Malt**, dissolution of the nitrogenous compounds in (PETIT and LABOURASSE), A., ii, 611.
 proteolytic diastase of (FERNBACH and HUBERT), A., ii, 576, 616.
 proteolytic enzyme of (WINDISCH and SCHELLHORN), A., i, 712.
- Malt-germ molasses**. See Agricultural Chemistry.
- Maltodextrin** (POTTEVIN), A., i, 81.
- isoMaltose**, Lintner's (POTTEVIN), A., i, 77.
- Mandarin**, oil of, methyl methylantranilate in (WALBAUM), A., i, 595.
- Manganese**, activity of, in promoting the phosphorescence of strontium sulphide (MOURELO), A., ii, 141.
- Manganese salts**, estimation of, by an alkaline solution of arsenious acid (REICHARD), A., ii, 109.
- Manganese borate** (OUVRARD), A., ii, 207.
 dibromide and tri- and tetra-chlorides (MEYER and BEST), A., ii, 77.
 chloride, stable hydrates of (DAWSON and WILLIAMS), A., ii, 210.
 tetrachloride, formation of (WACKER), A., ii, 470.
 chlorides, compounds of, with potassium chloride and with caesium chloride (MEYER and BEST), A., ii, 77.
 trifluoride (Mn_2F_6), preparation and properties of (MOISSAN), A., ii, 280.
 dioxide, formation of (WACKER), A., ii, 470.
 electrodes, potential differences with (TOWER), A., ii, 331.
 oxide, $22MnO_2 \cdot MnO \cdot xH_2O$ (CHRISTENSEN), A., ii, 596.
- Manganic acids**, estimation of, by an alkaline solution of arsenious acid (REICHARD), A., ii, 109.
- Permanganic acid**, preparation of, by electrolysis (MORSE and OLSEN), A., ii, 482.
- Permanganomolybdates** (FRIEDHEIM and SAMELSON), A., ii, 547.
 selenide and oxyselenide (FONZES-DIAON), A., ii, 348.
 copper sulphates, solubility of (STORTENBEKER), A., ii, 530.
 potassium sulphate (MALLET), T., 221; P., 1899, 227; (MEYER and BEST), A., ii, 78.
 thioantimonite and its double salt with potassium (POUGET), A., ii, 84.
- Manganous salts and ammonia**, equilibrium between (HERZ), A., ii, 68.
- Manganous fluoride**, MnF_2 (MOISSAN and VENTURI), A., ii, 405.
- Manganous iodide**, hydrates of (KUTZ NETZOFF), A., ii, 657.
- Manganese organic compounds**:—
 compounds of, with acetic acid (MEYER and BEST), A., ii, 77.
- Manganese, estimation of**:—
 estimation of, as pyrophosphate (BÖTTGER), A., ii, 443.
 estimation of, as sulphide (J. and H. S. PATTINSON), A., ii, 443.
 estimation of, in iron (HERTING), A., ii, 245.
 estimation of, volumetrically, in pig-iron, cast-iron, and steel (MIGNOT), A., ii, 690.
 estimation of, volumetrically, in iron or steel (NAMIAS), A., ii, 50.
 estimation of, in steel (JERVIS), A., ii, 444.
 estimation of, electrolytically, in manganese ores (HIORNS), A., ii, 444.
- Manganese ore** from the Amazon district (KATZER), A., ii, 733.
- Manganese nodules** from New South Wales (DOHERTY), A., ii, 283.
- Manganocalcite** from Chemnitz. See Angolite.
- Mangel-wurzel**. See Agricultural Chemistry.
- d-Mannitol**, compounds of, with nitrobenzaldehydes (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.
- Mannocellulose** in the tissues of gymnosperms (BERTRAND), A., ii, 610.
- Mannogalactan** from *Strychnos potatorum* and its dibenzoyl derivative (BAKER and POPE), T., 696; P., 1900, 72.
 from the seeds of *Trifolium repens* (HÉRISSEY), A., ii, 561.
- Mannose**, production of, by an enzyme (BOURQUELOT and HÉRISSEY), A., ii, 35, 233; (HÉRISSEY), A., ii, 561.
 from the albumen of the St. Ignatius bean and nux vomica (BOURQUELOT and LAURENT), A., ii, 498, 611.
 from invertin (KÖLE), A., i, 572.
- Manometer**, differential, new (BLEIER and KOHN), A., ii, 192.
- Manostat** (SMITS), A., ii, 388.
- Mantles**, luminosity of, of mixtures of ceria and thoria (THIELE), A., ii, 208.
- "Manur"**—a cheese from Servia (ZEGA), A., ii, 503.
- Manures**, estimation of potash in (ADIE and WOOD), T., 1079; P., 1900, 17.
 estimation of available phosphoric acid in (VEITCH), A., ii, 166.
 estimation of phosphoric acid available as plant food in (PLOT), A., ii, 510.

- Manures**, artificial, containing nitrates, estimation of nitrogen in (VEITCH), A., ii, 166.
See also *Agricultural Chemistry*.
- Marbles** (VOGT), A., ii, 734.
- Marc wines**. See *Wine*.
- Marcasite**, composition and heat of combustion of (CAVAZZI), A., ii, 598.
- Margarine** and butter, relative digestibility of, in the human intestine (LÜRRIG), A., ii, 224, 667.
nutritive value of, compared (BENTARELLI), A., ii, 224.
detection of yolk of egg in (MECKE), A., ii, 123.
detection of sucrose in (MECKE), A., ii, 319.
detection of sesamé oil in (BÖMER and WINTER), A., ii, 178; (BREMER; SOLTSIEN), A., ii, 325; (AMTHOR), A., ii, 453.
detection of, in cheese (FASCETTI and GHIGI), A., ii, 377.
- Maripa fat** (VAN DEN DRIESSEN-MAREEUW), A., ii, 773.
- Marls**, estimation of calcium carbonate in (NOLL), A., ii, 48.
See also *Agricultural Chemistry*.
- Marijatskite** from Bogoslawsk, Urala (v. FEDOROFF and NIKITIN), A., ii, 486.
- Mass law** and physical reactions (LINCOLN), A., ii, 392.
- Mastic resin**, examination of (DIETERICH), A., ii, 118.
- Meat**, preserved, isolation of glycogen from (BREUSTEDT), A., ii, 321.
estimation of boric acid in (BEYTHIEN and HEMPEL), A., ii, 313.
estimation of tin in, and the state in which it occurs (WIRTHLE), A., ii, 512.
- Meat extract**, carnosine from (v. GULEWITSCH and AMIRADŽIBI), A., i, 516.
- Meconic acid**, constitution of (PERATONER and LEONARDI), A., i, 550.
- Meconin**, thermochemistry of (LEROY), A., ii, 261.
- Meconindimethyl ketone** and its salts and methyl derivative (FULDA), A., i, 36.
- Melibiose**, crystallised (BAU), A., i, 77.
- Melilite group** of minerals (FOUQUÉ), A., ii, 551.
- Melinite** (?) from Moravia (KOVÁK), A., ii, 148.
- Melite** from Saalfeld, Thuringia (ZAMBONINI), A., ii, 150.
- Melitriose**. See *Raffinose*.
- Melonite** (?) from California (HILLEBRAND), A., ii, 22.
- Melonite** from S. Australia (HIGGIN), A., ii, 283; (DIESELDORFF), A., ii, 664.
- Melting point** and volume change (TAMMANN), A., ii, 714.
of various substances (LADENBURG and KRÜGEL), A., ii, 259.
of alkyldicarboxylic acids, and their amic acids and imides (AUWERS, MAYER, and SCHLEICHER), A., i, 85.
of homologues, regularities in the (SALZER), A., ii, 260.
relation between the boiling point and, in hydrocarbons (BAYLEY), A., i, 369.
- Melting point curves** of mixed crystals (ROOZEBOOM; REINDERS), A., ii, 70; (VAN EIJK), A., ii, 133.
of mixtures of optical isomerides (ROOZEBOOM), A., ii, 64; (ADRIANI), A., ii, 463.
- Melting point determinations**, method for (KUHARA and CHIKASHIGE), A., ii, 260.
apparatus for (HOUBEN), A., ii, 645.
apparatus for drying substances for (STREATFIELD and SOUTHERDEN), A., ii, 718.
- Membranes**, animal, influence of, on the diffusion of various substances (HEDIN), A., ii, 221.
semipermeable, electrolysis through (MORITZ), A., ii, 522.
- Memorial lectures**: Victor Meyer (THORPE), T., 169; P., 1900, 33; Bunsen (ROSCOR), T., 513; P. 1900, 84; Friedel (CRAFTS), T., 993; Nilsson (PETTERSSON), T., 1277.
- Mentha piperita**, oil of (CHARABOT), A., i, 303.
- Menthane**, nitration of (KONOWALOFF and JEBENKO), A., i, 324.
- Menthanementhylhydrazone** (KIJNER), A., i, 278.
- Menthazine** (KIJNER), A., i, 279.
- Menthene** from menthol (KONOWALOFF), A., i, 352.
synthesis of (TSCHUGAEFF), A., i, 129.
genesis of, in *Mentha piperita* (CHARABOT), A., i, 303.
- Menthol**, action of dry silver oxide and ethyl iodide on (LANDER), T., 731; P., 1900, 6.
- Menthol series**, isomerism in the (KONDAKOFF and LUTSCHININ), A., i, 104, 604.
- Menthomenthol**, preparation of (KONDAKOFF and LUTSCHININ), A., i, 104.
- Menthone**, genesis of, in *Mentha piperita* (CHARABOT), A., i, 303.
transformation of rhodinal into (BOUVEAULT), A., i, 452.
oxidation of (MARKOWNIKOFF), A., i, 476.

Menthonisooxime and its hydrolysis (WALLACH), A., i, 590.

Menthonesemicarbazone (RIMINI), A., i, 555.

Menthylamines, bromo-, action of silver oxide on (KIJNER), A., i, 278.

l-Menthylhydrazones and its compound with phenylthiocarbimide (KIJNER), A., i, 278.

Mercaptans (*thiols*), aromatic, preparation of (BOURGEOIS), A., i, 163.

Mercaptans. See also :—

Ethyl mercaptan.

2:6-Lutidyl 4-mercaptan.

Methylnaphthiazolyl mercaptan.

Methylpyrimidinethiols.

Naphthatriazolyl mercaptan.

β -Naphthyl mercaptan.

Phenyl mercaptan.

Pyridyl mercaptan.

Tolyl mercaptans.

Xylylene hydrosulphides.

Xylylenemethylenemercaptals.

Mercaptoles (POSNER and FAHRENHORST), A., i, 16.

of ketonic acids (POSNER), A., i, 5;
(POSNER and FAHRENHORST), A., i, 16.

Mercarbide and its salts (HOFMANN), A., i, 383.

Mercury, purification and vapour tension of (HULETT), A., ii, 543.

vapour density of (BAKER), T., 648;
P., 1900, 68.

compressibility of (HULETT), A., ii, 397.

solubility of metals in (LARSEN), A., ii, 255.

action of, on methylene iodide (THOMAS), A., i, 213.

Mercury alloys (*amalgams*) (KURNAKOFF), A., ii, 277; (GUNTZ and FÉRÉE), A., ii, 540; (KERP and BÖTTGER), A., ii, 656.

dilute, influence of temperature on the electrical conductivity of (LARSEN), A., ii, 255.

distillation of (HULETT), A., ii, 543.

with aluminium, action of, on alcohols (TISTSCHENKO), A., i, 269.

with cadmium, with lithium, with rubidium, and with strontium (KERP and BÖTTGER), A., ii, 656.

with potassium and sodium (KURNAKOFF), A., ii, 277; (GUNTZ and FÉRÉE), A., ii, 540; (KERP and BÖTTGER), A., ii, 656.

Mercurammonium compounds, formulae of (HOFMANN and MARBURG), A., ii, 279.

Diammoniomercuric iodide, action of ammonia on (FRANÇOIS), A., ii, 208, 346.

Mercurammonium compounds:—

Mercuriammonium iodide, formation of (FRANÇOIS), A., ii, 346.

Dimercuriammonium iodide, anhydrous, amorphous and crystalline (FRANÇOIS), A., ii, 280.

Mercury compounds, isomorphous, with gold (BEHRENS), A., ii, 213.

Mercury salts, action of sodium thiosulphate on (FAKTOR), A., ii, 627; (NORTON), A., ii, 689.

Mercury antimonide (PARTHEIL and MANNHEIM), A., i, 479.

iodides, direct formation of crystallised (BODROUX), A., ii, 543.

ammonium and potassium iodides, dissociation of (FRANÇOIS), A., ii, 142.

phosphide and the action of methyl and ethyl iodide on (PARTHEIL), A., ii, 543.

selenide, action of hydrogen on, and the inverse action (PÉLABON), A., ii, 346.

chlorosulphide (BODROUX), A., ii, 481.

Mercuric bromide and iodide, mixed crystals of (REINDERS), A., ii, 70.

chloride (*corrosive sublimate*), action of, on hydrogen phosphide (PARTHEIL), A., ii, 543.

effect of oxidising agents on the reduction of, by oxalic acid (KASTLE and BRATTY), A., ii, 627.

estimation of, volumetrically (RUPP), A., ii, 628.

estimation of, in dressings (LEHMANN), A., ii, 443, 511; (UTZ), A., ii, 762.

iodide, transformation temperature of (GERNEZ), A., ii, 141.

effect of solvents on the allotropic change of (KASTLE and CLARK), A., ii, 141.

action of, on alkyl sulphides (SMILES), T., 163; P., 1899, 240.

action of ammonia on (FRANÇOIS), A., ii, 208.

oxide, red and yellow, isomerism of (COHEN), A., ii, 184, 381; (ORTWALD), A., ii, 712.

action of iodine on (ORTON and BLACKMAN), T., 835; P., 1900, 104.

Mercurous chloride, vapour density of dried (BAKER), T., 646; P., 1900, 68.

iodide (RAY), P., 1899, 239.

nitrite, action of, on ethyl iodide (RAY), P., 1899, 239.

sulphate, action of water on (GOUY), A., ii, 481.

Mercury organic compounds:—

Mercury salts, action of allyl alcohol on (SAND and HOFMANN), A., i, 386; (BIILMANN), A., i, 431; (HOFMANN and SAND), A., i, 618.

action of ethylene on (HOFMANN and SAND), A., i, 384, 618; (BIILMANN), A., i, 431.

action of propylene and butylene on (SAND and HOFMANN), A., i, 385.

of ketonic acids, and their conversion into mercurioketonic acids (LEY), A., i, 382.

Mercury halogen derivatives, compounds of, with antipyrine (VILLE and ASTRE), A., i, 362, 411.

compounds of, with iodoantipyrine, (BOUGAULT), A., i, 361.

sulphate, compound of, with acetone-dicarboxylic acid (DENIGES), A., i, 39.

Mercuriacetic acid, bromo- and iodo- (HOFMANN and SAND), A., i, 385.

Trimercuriacetic acid (HOFMANN), A., i, 383.

Mercuribenzoic acid, chloro-, bromo-, and iodo-, and their salts (PESCI), A., i, 546.

Mercurilævulic acids (LEY), A., i, 382.

Mercurisalicilic acid (LINTNER), A., ii, 631.

Mercuric cyanide and cyanate, estimation of (VINCENT), A., ii, 174.

Mercury-dimethyl, -diethyl, and -diphenyl, heat of combustion and of formation of (BERTHELOT), A., ii, 129.

Mercurydimethyl, action of nitric peroxide on (BAMBERGER and MÜLLER), A., i, 145.

p-**Mercuriodiphenylenetetraethylmercuridiammonium acetate**, physiological action of (BENEDICENTI and POLLEDRO), A., ii, 359.

"**Meruroheptanaphthene iodide**" (KURSANOFF), A., i, 89.

Mercury, detection and estimation of:— delicate test for (CAZENEUVE), A., i, 465.

detection of, in urine (HOEHNEL), A., ii, 368; (JOLLEN), A., ii, 576.

estimation of, in urine (SCHUMACHER and JUNG), A., ii, 247; (JOLLEN), A., ii, 576; (FARUP; WERDER), A., ii, 689.

clinical estimation of, in urine (ESCHBAUM), A., ii, 368.

estimation and separation of, as mercurous oxalate (PETERS), A., ii, 576.

β-**isoMeroquinenine** (*β*-*isomerochinene*) and its aurichloride (SKRAUP), A., i, 605.

Mesenteric cyst, composition of the liquid contained in a (RICHAUD and BONNEAU), A., ii, 557.

Mesidine, bromo- [$\text{Me}_2\text{NH}_2\text{Br} = 1:3:5:2:4$] (FISCHER and WINDAUS), A., i, 434.

Mesitol, *di*- and *tri*-bromo-, oxidation products of (AUWERS), A., i, 161; (AUWERS, BROICHER, and WOLFF), A., i, 162.

phenylurethanes of (AUWERS, TRAUN, and WELDE), A., i, 166.

Mesityl bromide, action of sodium on (WEILER), A., i, 213.

Mesitylene (1:3:5-*trimethylbenzene*), refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237. oxidation of (WEILER), A., i, 284.

Mesitylene, bromo-, action of sodium on (WEILER), A., i, 213.

chloro-iodo-, -iodoso-, -iodoxy-, -iodoso-, and -iodoxy-, and some of their salts (WILLGERODT and RONGATZ), A., i, 432.

Mesitylenediacetate (HANTZSCH), A., i, 568.

Mesityl oxide (*methyl isobutenyl ketone*; *isopropylideneacetone*), its halogen and acetoxy and methoxy derivatives (PAULY and LIECK), A., i, 274.

action of amidines on (TRAUBE and SCHWARZ), A., i, 116.

condensation of, with ethyl sodium-methylmalonate (CROSSLEY), P., 1900, 90.

α-**Mesityloxime**, oxidation of (HARRIES), A., i, 504.

Mesoxamide, oxime of, and its salts and acetyl and ethyl derivatives, and the action of nitrous acid on (WHITELEY), T., 1040; P., 1900, 145.

Metabolism, influence of the kind and amount of nutriment on (PFLÜGER), A., ii, 91.

influence of sodium salicylate on (GOODBODY), A., ii, 670.

influence of removal of water on (STRAUB), A., ii, 91.

human, rôle of purine substances in (BURIAN and SCHÜR), A., ii, 489.

during poisoning with pulegone (LINDEMANN), A., ii, 223.

nitrogenous, after splenectomy (MENDEL and JACKSON), A., ii, 288.

proteid (ALBU), A., ii, 151.

during gelatin feeding (KIRCHMANN), A., ii, 669.

influence of sodium chloride injected subcutaneously on (KRUMMACHER), A., ii, 670.

Metabolism, proteid, in plants (SCHULZE), A., ii, 745.
 in pernicious anæmia (v. MORACZEWSKI), A., ii, 295.
 in leucæmia (v. STEJSKAL and ERBEN), A., ii, 423.
 in children (CAMERER and SÖLDNER), A., ii, 222.
 mineral, in naturally and artificially fed infants (BLAUBERG), A., ii, 669.
 in a vegetarian (RUMPF and SCHUMM), A., ii, 222.
 in full-grown bullocks with maintenance and fattening foods (KELLNER and KÖHLER), A., ii, 563, 565, 566.
 nitrogenous, in the cat (MENDEL and BROWN), A., ii, 151.
 in frogs (v. MORACZEWSKI), A., ii, 31.
 in horses (PFEIFFER), A., ii, 554.
 in Ruminants (HAGEMANN), A., ii, 222.
 proteid, in Ruminants, influence of ammonia and asparagine on (KELLNER, KÖHLER, BARNSTEIN, ZIELSTORFF, EWERT, and WEDEMEYER), A., ii, 417.
 of arsenic (GAUTIER), A., ii, 670.
 with edestin, and with calcium and magnesium (LEIPZIGER), A., ii, 223.
 of iodine (GAUTIER; BOURCET), A., ii, 670.
 of nuclein (LOEWI), A., ii, 417.
 of nucleins (MILROY and MALCOLM), A., ii, 91.
 of phosphorus (NOËL-PATON, DUNLOP, and AITCHISON), A., ii, 222; (LEIPZIGER), A., ii, 223.
 gaseous, of the submaxillary gland (BARCROFT), A., ii, 417.
Metal-ammonia compounds, nature of, in aqueous solution (DAWSON and McCRAE), T., 1239; P., 1900, 172.
Metallic chlorides, decomposition of (OECHSNER DE CONINCK), A., ii, 485, 543.
 compounds, fluorescence of, under the influence of Röntgen and Becquerel rays (BARY), A., ii, 330.
 crystallisation by electric currents (TOMMASINA), A., ii, 185; (TOMMASI), A., ii, 339.
 hydroxides, energy of some, deduced from the hydrolysis of their salts (CARRARA and VESPIGNANI), A., ii, 647.
 salts, effect of concentration on the magnetic rotation of (FORCHHEIMER), A., ii, 524.
 action of alkali hydroxides and bromine on (VITALI), A., ii, 208.
 solutions, colloidal. See Colloidal.

Metals, indices of refraction of (VAN AUBEL), A., ii, 125.
 influence of light on the electrical properties of (BUISSON), A., ii, 519.
 passivity of (HITTOFF), A., ii, 705.
 specific heat of (TILDEN), A., ii, 524.
 specific heat of, at low temperatures (BEHN), A., ii, 259.
 reciprocal displacement of (COLSON), A., ii, 140.
 catalytic action of some (ŠULC), A., ii, 395.
 solubility of, in mercury (LARSEN), A., ii, 255.
 electrolytically deposited, reducing action of (BINZ and HAGENBACH), A., ii, 384.
 action of very dilute nitric acid on (VAN BIJLERT), A., ii, 204.
 influence of, on broth cultures of Bacteria (ISACHENKO), A., ii, 230.
 combination of, with nucleins (STASSANO), A., ii, 559.
 heavy, fused halogen compounds of, change of free energy and ionic concentrations in (LORENZ), A., ii, 61.
 noble, alloys of the, estimation of iridium in (MIETZSCHKE), A., ii, 371.
 behaviour of rhodium in (RÜSSLER), A., ii, 732.
 application of the Kjeldahl method of destroying organic substances in the detection of (GRAS and GINTL), A., ii, 111.
 diphenylcarbazine as a reagent for (CAZENEUVE), A., ii, 627.
 detection of, by the absorption spectra of their compounds with alkanna (FORMÁNEK), A., ii, 687.
 estimation of arsenic in (HOLLARD and BERTIAUX), A., ii, 438.
Metapurpuric acid. See under Purpuric acid.
Meteoric irons (COHEN), A., ii, 664.
 from Bethany, Great Namaqualand (COHEN), A., ii, 736.
 from Griqualand East, South Africa (COHEN), A., ii, 736.
 from Iredell, Texas (FOOTE), A., ii, 150.
 from Morradal, Norway (COHEN), A., ii, 488.
 from Patagonia (FLETCHER), A., ii, 27.
 from Quesá, Spain (BOSCÁ Y CASANOVES; COHEN), A., ii, 415.
 from Youndegin, Western Australia (FLETCHER), A., ii, 27.
Meteorite, new, from Allegan, Michigan, and from Mart, Texas (MERRILL and STOKES), A., ii, 737.

- Meteorite** from Ergheo, Somaliland (ARTINI and MELZI), A., ii, 488.
 from Illinois Gulch, Montana (PRESTON), A., ii, 287.
 from Jamysheff and Tubil river, Siberia (ANTIPOFF), A., ii, 220.
 from Oakley, Kansas (PRESTON), A., ii, 552.
- Meteorites**, two new American (PRESTON), A., ii, 355.
- Methæmoglobin**. See under Hæmoglobin.
- Methane** and mixtures of methane and hydrogen and air, limits of combustibility of, passed over red-hot cupric oxide (GAUTIER), A., ii, 469.
 tri- and tetra-halogen substituted, action of alcoholic potash, sodium ethoxide, or potassium cyanide and metals on (NER), A., i, 2.
 bromine derivatives of (POURET), A., i, 369.
tetrachloro-. See Carbon *tetrachloride*.
 nitro-, action of alkalis and ammonia on (DUNSTAN and GOULDING), T., 1262; P., 1900, 174.
 isonitro-, action of diazobenzene on (BAMBERGER, SCHMIDT, and LEVINSTEIN), A., i, 566.
- Methazonic acid**, preparation, constitution and reactions of (DUNSTAN and GOULDING), T., 1264; P., 1890, 174.
- Methenyl compounds**, mixed (EHRERA), A., i, 38.
- Methoethene-5-hexene-2-acid-6**. See α -*iso*Propylidene- γ -hexenoic acid.
- Methoethiol-5-hexene-2-acid-6**. See α -Hydroxyisopropyl- γ -hexenoic acid.
- 2-Methothio-1-phenyl-4:4:6-trimethyl- and 2-Methothio-4:4:6-trimethyl-1-allyl-dihydropyrimidine** (TRAUBE and LORENZ), A., i, 116.
- Methoxide**, sodium, action of, on the dibromides of propenyl compounds and of unsaturated ketones (POND, MAXWELL, and NORMAN), A., i, 102.
- 2-Methoxyacetylacetophenone** (BLOCH and v. KOSTANECKI), A., i, 502.
- p*-Methoxybenzonitrile** (HENRY), A., i, 172.
- o*-Methoxybenzyl alcohol** and methyl and ethyl ethers (PSCHORR, WOLFES, and BUCKOW), A., i, 232.
- β -Methoxy- β -benzylacrylic acid**, α -cyano-, methyl ester (HALLER and BLANC), A., i, 496.
- p*-Methoxybenzylidenebis-2-methyl-indole** (v. WALTHER and CLEMEN), A., i, 408.
- Methoxybenzylidene-*d*- and -*l*-camphors**, *o*- and *p*- (HALLER), A., i, 301.
- p*-Methoxybenzylidene-2-naphthylamine**, 1-bromo- and 1-chloro-, and their hydrocyanides (MORGAN), T., 1216; P., 1900, 171.
- 4-Methoxydibromocanthraquinone** (PSCHORR and JAECKEL), A., i, 489.
- p*-Methoxycinnamic acid**, ethyl ester, from the oil of *Kaempferia Galanga* (VAN ROMBURGH), A., i, 677.
- Methoxycoumarones**, 4- and 5- (STOERMER), A., i, 655.
- 3'-Methoxy-2:4'-diethoxy-flavanone and -flavone** (v. KOSTANECKI and SCHMIDT), A., i, 238.
- o*-Methoxydiphenylcarbamide** (RANSOM), A., i, 219.
- 4'-Methoxy-6-ethoxyflavanoneoxime** (v. KOSTANECKI), A., i, 449.
- Methoxyethylideneoxanilide** (v. PECHMANN and ANSEL), A., i, 389.
- 6-Methoxy-glauconic and -hydroglauconic acids** (DOEBNER), A., i, 313.
- p*-Methoxyhydratropic acid**, synthesis of (BOUGAULT), A., 495, 548.
- 5-Methoxyhydrindene** (MOSCHNER), A., i, 344.
- Methoxymesityl oxide** (PAULY and LIECK), A., i, 275.
- 5-Methoxy-7-methyl-1:3-diketohydrindene-4-mono- and -2:4-dicarboxylic acids**, methyl esters (LANDAU), A., i, 661.
- Methoxy-3-methylisoquinolines**, 4- and 1-, 1- and 4-chloro- (GABRIEL and COLMAN), A., i, 359.
- Methoxynaphthalic anhydride** (ANSELM and ZUCKMAYER), A., i, 176.
- 3-Methoxyphenanthraquinone** (PSCHORR, WOLFES, and BUCKOW), A., i, 233.
- 4-Methoxyphenanthraquinone, dibromo-** (PSCHORR and JAECKEL), A., i, 489.
- Methoxyphenanthrenes**, 1- and 3-, synthesis of, and their 10-carboxylic acids (PSCHORR, WOLFES, and BUCKOW), A., i, 232.
- 4-Methoxyphenanthrene and its dibromoderivative and 2-carboxylic acid** (PSCHORR and JAECKEL), A., i, 488.
- β -*o*-Methoxyphenoxycinnamic acid** and its ethyl ester (RUHEMANN and STAPLETON), T., 1180; P., 1900, 168.
- o*-Methoxyphenoxystyrene** (RUHEMANN and STAPLETON), T., 1181; P., 1900, 168.
- o*-Methoxyphenylacetic acid** (PSCHORR, WOLFES, and BUCKOW), A., i, 232; (LEBEDEFF), A., i, 490.
- β -Methoxy- β -phenylacrylic acid** α -cyano-, ethyl ester (HALLER and BLANC), A., i, 496.
- p*-Methoxyphenylcarbamie acid**, ethyl ester and *p*-Methoxyphenylcarbimide (VITTENET), A., i, 154.

- o*-Methoxyphenylcarbamide** (RANSOM), A., i, 219.
- 3-*p*-Methoxyphenyl-2-carbostyryl** (PSCHORR and WOLFFES), A., i, 170.
- o*-Methoxyphenyl-di- and -tri-chloromethylcarbinols** and their acetyl derivatives (LEBEDEFF), A., i, 490.
- α -*o*-Methoxyphenyl- β -*o*-nitroacetyl-vanillylacrylic acid**, synthesis with (PSCHORR), A., i, 233.
- α -*o*- and -*p*-Methoxyphenyl-*o*-nitrocinamic acids**, syntheses from (PSCHORR, WOLFFES, and BUCKOW), A., i, 232.
- 3-*p*-Methoxyphenylquinoline, 2-amino-** (PSCHORR and WOLFFES), A., i, 170.
- o*-Methoxyphenylurethane** (RANSOM), A., i, 219.
- 4-Methoxyisoquinoline, 1-chloro-** (GABRIEL and COLMAN), A., i, 358.
- p*-Methoxystilbene**, and its chloro-, bromo-, and nitro-derivatives (v. WALTHER and WETZLICH), A., i, 438.
- o*-Methoxystyrene, - β -dichloro-** (LEBEDEFF), A., i, 490.
- Methyl alcohol**, boiling point of, with mixtures of benzene, carbon tetrachloride, ether, and ethyl alcohol (HAYWOOD), A., ii, 64.
- detection of (JANDRIER), A., ii, 52.
- detection of, in alcohols (WOLFF), A., ii, 111.
- Methylacetalyl-quinol, and -resorcinol** (STOERMER), A., i, 655.
- Methylacetyl-*p*-acetaminobenzoic acid** (TROEGER), A., i, 227.
- Methylacetylcarbinol** (HENRY), A., i, 538.
- Methylacetylmalononitrile** (HENRY), A., i, 538.
- Methylacrylic acids, α - and β -**, ethyl esters, condensation of, with ethyl sodiocyanoacetate (HOWLES, THORPE, UDALL, and NEALE), T., 947; P., 1900, 115.
- Methyladipic acids, α - and β -** (MARKOWNIKOFF), A., i, 475.
- Methylal**, heat of combustion and of formation of (BERTHELOT and DELÉPINE), A., ii, 334.
- Methylalisanin and its diacetyl derivative** (v. NIEMENTOWSKI), A., i, 450.
- Methylallantoins, α - and β -**, from the methyluric acids (FISCHER and ACH), A., i, 65.
- Methylallylaniline**, and the action of cyanogen bromide on (v. BRAUN), A., i, 642.
- Methylamine**, spectrum of (HARTLEY and DOBBIE), T., 320; P., 1900, 14.
- action of iodine chloride on (ORTON and BLACKMAN), T., 833; P., 1900, 103.
- Methylamine**, hydrates of, heat of formation of (DE FORCRAND), A., ii, 476.
- cadmium haloids (BAGLAND), A., i, 141.
- tellurium chloride (LENHER), A., i, 379.
- tin haloids (COOK), A., i, 142.
- Methylaminocombelic acid** (HEFFTER and FEUERSTEIN), A., i, 498.
- 3-Methylaminoflavinduline salts, 2-amino-** (KEHRMANN and STOFFEL), A., i, 254.
- 7-Methylamino-4-methylcoumarin** (v. PECHMANN), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.
- Methylaminomethyl-2-piperidone** (WILLSTÄTTER), A., i, 405.
- Methyl-*o*-aminophenol**, oxidation products of (DIEPOLDER), A., i, 191.
- Methyl amyl diketoxime**, diacetyl derivative of (PONZIO), A., i, 588.
- γ -Methyl- β -amylene and δ -Methyl- γ -amylene**. See Hexylene.
- $\alpha\alpha$ -Methylisamylsuccinic acid** and its oxidation products (LAWRENCE), P., 1900, 156.
- $\alpha\alpha$ -Methylisamylsuccinic acids, *cis*- and *trans*-**, dissociation constants of (BONE and SPRANKLING), T., 1304; P., 1900, 184.
- Methylaniliminocarbaminothioglycollic acid** (HARRIES and KLAMT), A., i, 413.
- Methylaniline**, action of formaldehyde on (GOLDSCHMIDT), A., i, 436.
- Methyl-*o*-anisidine**, oxidation products of (DIEPOLDER), A., i, 191.
- β -Methylantracone** from *p*-toluoyl-*o*-benzoic acid (LIMPRICHT and WIEGAND), A., i, 498.
- Methylantranillic acid**, methyl ester, in oil of mandarin (WALBAUM), A., i, 595.
- β -Methylantraquinone** from *p*-toluoyl-*o*-benzoic acid (LIMPRICHT and WIEGAND), A., i, 498.
- Methylation** of colouring matters (PRUD'HOMME), A., i, 244.
- and sulphonation, simultaneous, of colouring matters (PRUD'HOMME), A., i, 455.
- p*-Methylbenzaldazine**, reduction of (CURTIUS), A., i, 611.
- 1-Methylbenzoxazole 4-carboxylic acid**, ethyl ester (EINHORN), A., i, 441.
- p*-Methylbenzyl-hydrazine** and -semicarbaside and their derivatives (CURTIUS), A., i, 612.
- p*-Methylbenzylhydrazine**, nitroso- (CURTIUS), A., i, 699.
- p*-Methylbenzyl-*p*-methylbenzylidene-hydrazine** and its derivatives (CURTIUS), A., i, 611.

- 2-Methyl-2-bromopropanal.** See *iso-Butaldehyde*, α -bromo-.
- Methyl-2-butanolic acid.** See *n*-Valeric acid.
- Methyl isobutenyl ketone.** See *Mesityl oxide*.
- Methyl-*n*-butylbenzenes**, *o*-, *m*-, and *p*-(*n*-butyltoluenes) (NIEMCZYCKI), A., i, 636.
- Methyl isobutyl diketoxime**, diacetyl derivative of (PONZIO), A., i, 588.
- γ -Methyl- β -butylene.** See *Amylene*.
- α -Methyl- α -isobutylglutaric acid**, and its oxidation, and α -cyano-derivative (LAWRENCE), P., 1900, 165.
- Methylisobutylglutaric acids**, *cis*- and *trans*-, and their anhydrides and anilic acids (LAWRENCE), P., 1900, 154.
- β -Methyl-*tert*.butylhydracrylic acid** and its salts (TALANZEFF), A., i, 328.
- 4-Methyl-6-butyl-1:2-phthalic acid** (BAUR-THURGAU), A., i, 640.
- α -Methyl- α -isobutylpropanetricarboxylic acid**, and its ethyl ester (LAWRENCE), P., 1900, 154.
- $\alpha\alpha$ -Methylisobutylsuccinic acids**, *cis*- and *trans*-, preparation and dissociation constants of (BONE and SPRANKLING), T., 1903; P., 1900, 184.
- Methylbutyric acid.** See *Valeric acid*.
- 2-Methylcamphenepyrrole** and its 3-acyl derivatives and 3-carboxylic acids (DUDEN and TREFF), A., i, 672.
- 2-Methylcamphenepyrroline** and its 3-acetyl derivative and 3-carboxylic acid (DUDEN and TREFF), A., i, 672.
- Methylisocarbamide** (STIEGLITZ and MCKEE), A., i, 340, 431.
- Methylcarbasolenine** (PLANCHER), A., i, 562.
- 3-Methylisocarbostyryl** (GABRIEL and COLMAN), A., i, 359.
- Methylcarboxyresoroylactic acid** (GILBODY, PERKIN, and YATES), P., 1900, 106.
- Methyl- α -chloroethylketonedithyldisulphone** (POSNER and FAHRENHORST), A., i, 17.
- 2-Methylchromone** (BLOCH and v. KOSTANECKI), A., i, 502.
- 4-Methylcoumarin**, 7-amino-, and its acyl derivatives (v. PECHMANN), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.
- 4-Methylcoumarin-7-trimethylammonium iodide** (v. PECHMANN), A., i, 173; (v. PECHMANN and SCHWARZ), A., i, 174.
- Methylcoumarones**, isomeric (STOERMER), A., i, 650.
- Methylcyanacetic acid**, ethyl ester, constitution of the sodium derivative of (THORPE), T., 923; P., 1900, 113.
- Methyleyananiline** (SCHOLL and NÜRR), A., i, 435.
- Methyleytisine** (RAUWERDA), A., i, 607, 684.
- Methyldiallylcarbinol**, pentahydric alcohol from, and its acetyl derivatives (MAXIMOVITSCH), A., i, 325.
- Methyl-*m*-diasine.** See *Methylpyrimidine*.
- Methyl-diisobutyl- and -diamylsulphines**, platinichlorides of (STRÖMHOLM), A., i, 326.
- Methyldiethylsulphine iodide** mercuric iodide (SMILEN), T., 162; P., 1899, 240.
- 6-Methyldihydroquinaldine** (DOEBNER), A., i, 313.
- Methyldilituric acid**, and its salts, and bromo- and chloro- (ANDREASCH), A., i, 479.
- Methyl-1:1-dimethylpyrrolidinium haloids** (WILLSTÄTTER), A., i, 249.
- Methyldipropylsulphines**, platinichlorides of (STRÖMHOLM), A., i, 326.
- Methylene derivatives**, condensation of, with aromatic nitroso-compounds (SACHS), A., i, 362.
- iodide**, action of mercury on (THOMAS), A., i, 218.
- sulphate** (DELÉPINE), A., i, 180.
- action of**, on benzyl alcohol (DELÉPINE), A., i, 163.
- dithiocarbonate**, bromo- (KONOW-LOFF and PLOTNIKOFF), A., i, 323.
- Methyleneasparagine** (SCHIFF), A., i, 85.
- Methylenebis-1-bromo- and -1-chloro-2-naphthylamine** (MORGAN), T., 814; P., 1900, 131.
- Methylenebisdihydroresorcinol**, **Methylenebis-mono- and -di-methyldihydroresorcinol**, and **Methylenebisphenyldihydroresorcinol** (VORLANDER and KALKOW), A., i, 99.
- Methylenebis-2-methylindole** and its nitro-derivatives (v. WALTHER and CLEMEN), A., i, 408.
- Methylenedibenzasimide** (*methylenebis-benzotriazole*) (MEYER and ROHMER), A., i, 223.
- Methylenedibenzsiminasole** and its salts (MEYER and ROHMER), A., i, 223.
- Methylenedi-2-ethyl- and -2-methylbenzsiminasole**, and their salts (MEYER and ROHMER), A., i, 223.
- 4-*mp*-Methylenedioxybenzylidenebis-1-phenyl-3-methyl-5-pyrazolone** (TANBOR and LICHSKI), A., i, 364.
- Methyleneglutamine** (SCHIFF), A., i, 86.
- Methyleneglucose** and its osazone (TOLLENS), A., i, 15.
- Methylene-group**, method of entering the molecule of a polyhydric acid or alcohol (TOLLENS), A., i, 205.

- Methylenehomosparagine** (SCHIFF), A., i, 86.
- m*- and *p*-**Methylenemalononic acids**, ethyl esters, preparation and distillation of (BOTTOMLEY and PERKIN), T., 306; P., 1900, 16.
- Methylenemalononic** and *p*-**Methylenemalononic acids**, ethyl esters, hydrolysis of (BOTTOMLEY and PERKIN), T., 306; P., 1900, 16.
- Methylene-*d*- and -*l*-mannonic lactones** (CLOWES and TOLLENS), A., i, 205.
- Methylenepapaverine** and its salts (KÖRNIGS), A., i, 190.
- Methylenetetraphenyldiquinoxaline** (MEYER and ROHMER), A., i, 224.
- Methyl ethyl sulphide-mercuric iodide** (SMILES), T., 164; P., 1899, 240.
- Methylethylacetyl sulphine** platinichloride (STRÖMHOLM), A., i, 326.
- Methylethylacetoxime**, chloro- (PATIEFF), A., i, 14.
- β -Methylethylacrylic acid**. See Hexenoic acid.
- Methylethylacetyl sulphine** bromide and picrate (SMILES), T., 1175; P., 1900, 168.
- Methyl ethyl diketoxime**, diacetyl derivative of (PONZIO), A., i, 588.
- β -Methylethylhydracrylic acid** and its salts (POKROVSKY), A., i, 328.
- Methyl ethyl ketone** and its acetyl, chloro-, and bromo-derivatives (HENRY), A., i, 537.
- mutual solubility of water and, in presence of alcohol (BRUNI), A., ii, 196.
- d*- and *l*-**Methylethylphenacetyl sulphine** *d*-bromocamphorsulphonates and picrates (SMILES), T., 1175; P., 1900, 168.
- i*-**Methylethylphenacetyl sulphine** bromide and picrate (SMILES), T., 1175; P., 1900, 168.
- Methylethylphenonaphthacridium** bromide, amino- ("aminomethylethyl-naphthacridium bromide"), and its acetyl derivative (ULLMANN and NAEF), A., i, 689.
- Methylethyl- α - and - β -propionethetines** salts (VANZETTI), A., i, 327.
- d*-**Methylethyl-*n*-propyl tin iodide** (POPE and PEACHEY), P., 1900, 42.
- d*-bromocamphorsulphonate (POPE and PEACHEY), P., 1900, 116.
- Methylethyl-propyl-, -butyl-, -amyl-, -hexyl-, and -octyl-sulphines** and their salts (STRÖMHOLM), A., i, 325.
- Methylethylthetine**, attempts to resolve (SMILES), T., 168; P., 1899, 240.
- resolution of, into active components (POPE and PEACHEY), T., 1072; P., 1900, 12.
- Methylethylthetine tartrate**, attempts to resolve (STRÖMHOLM), A., i, 328.
- d*-**Methylethylthetine** platinichloride, *d*-camphorsulphonate, and *d*-bromocamphorsulphonate (POPE and PEACHEY), T., 1072; P., 1900, 12.
- 4-Methyl-4-ethyltrimethylenedicarbonimide**, 3:5-dicyano- (dicyanohomocarbonimide), (GUARESCHI and GRANDE), A., i, 111.
- iso***Methyleugenol**, acid, $C_{14}H_{14}O_4$ from the oxidation of (BOUGAULT), A., i, 495.
- Methylfurfuraldehyde**, spectrum of (ANDRLEK), A., i, 110; (WIDTSOE and TOLLENS), A., i, 244.
- 1-Methylfurfuraldehyde-*p*-nitrophenylhydrazones** (FEIST), A., i, 569.
- Methyl furfuryl ketone** and its oxime (SANDELIN), A., i, 305.
- 6-Methyl-glauconic and -hydroglauconic acids** (DOEBNER), A., i, 313.
- Methylglutaric acids**, α - and β - (*butanedicarboxylic acids*) (HOWLES, THORPE, and UDALL), T., 947; P., 1900, 116.
- Methylglyoxal-*p*-ethoxyphenylhydrazoxime**, -osazones, and -osotetrazones (AUDEN), P., 1899, 230.
- Methylglyoxal-methylphenylphenyl-osazones** and -salicylic acid osazones (AUDEN), P., 1899, 231.
- β -Methyl- α -heptadienolic acid** (v. BRAUN and STECHELE), A., i, 429.
- Methyl-2-heptene-4-one-6**, and its mono- and di-semicarbazones (TIEMANN), A., i, 275.
- Methylcycloheptenoneoxime**, reactions of and bases from (WALLACH), A., i, 45.
- Methylcyclohexamethylene ketone** from pulegone (KONOWALOFF), A., i, 352.
- Methylcyclohexane** (*heptanaphthene*, *methyl-naphthene*, *hexahydrotoluene*), (KURSANOFF), A., i, 19.
- derivatives of (MARKOWNIKOFF and TSCHERDINTZEFF), A., i, 578; (MARKOWNIKOFF), A., i, 579.
- 3-bromoamino-, action of silver oxide on (KIJNER), A., i, 278.
- 3:3-dichloro- (KLAGES), A., i, 44.
- β -Methylhexane- γ -el- ϵ -one**. See *iso*-Butyralacetone.
- 1:1-Methylcyclohexanol** (*tert.heptanaphthenol*) and its chloride (MARKOWNIKOFF and TSCHERDINTZEFF), A., i, 578.
- 1:3-Methylcyclohexanol** and its halogen derivatives (MARKOWNIKOFF), A., i, 579.
- and its bromide, physical constants of (KONDAKOFF and SCHINDELMEISER), A., i, 508.

- 1-Methyl-3-cyclohexanone** (KLAGES) A., i, 44; (WALLACH), A., i, 179.
physical constants of, and reduction of (KONDAKOFF and SCHINDELMEISER), A., i, 508.
oxidation of (MARKOWNIKOFF), A., i, 475.
- Methylcyclohexanoneoxime**, action of phosphoric oxide on (WALLACH), A., i, 45.
- Methylcyclohexanoneisoximes** and their separation and hydrolysis (WALLACH), A., 45, 590.
- 1-Methyl- $\Delta^{1,2}$ -cyclohexene** (α -*naphthylene*) (MARKOWNIKOFF and TSCHERDINTZEFF), A., i, 578.
- 1-Methyl- $\Delta^{1,3}$ -cyclohexene** (β -*naphthylene*) (MARKOWNIKOFF), A., i, 579.
- 1:3-Methylcyclo-hexenone** and -hexylhydrazine and its compound with phenylthiocarbimide (KIJNER), A., i, 278.
- 4-Methyl-4-hexyltrimethylenedicarbonimide**, 3:5-dicyano- (GUARESCHI and GRANDE), A., i, 112.
- 2-Methyl-3-hydroxyethylcamphane-pyrrolidine** and its isomeride (DUDEN and TREFF), A., i, 672.
- 2-Methyl-6:7-hyptazarin** and its diacetyl derivative (v. NIEMENTOWSKI), A., i, 450.
- 1-Methylindene** (MARCKWALD), A., i, 434.
- 2-Methylindole** (*methylketole*), condensation of, with aldehydes, ethyl acetate, and with phenylcarbimide, and the action of nitric acid on (v. WALTHER and CLEMEN), A., i, 408.
- 2-Methylindolephenyl-carbamide** and -thiocarbamide (v. WALTHER and CLEMEN), A., i, 408.
- Methylisuretine** (BIDDLE), A., i, 137.
- Methyljapaeonitine** and its aurichloride (DUNSTAN and READ), T., 54; P., 1899, 207.
- 2-Methyl-4-ketodihydroquinazoline**, synthesis of (BOGERT and GOTTHELF), A., i, 412, 608.
- 1-Methyl-2-ketohexamethylenecarboxylic acid**, ethyl ester (DIECKMANN), A., i, 624.
- Methylketole**. See 2-Methylindole.
- Methylketopentamethylenecarboxylic acid**. See Methylcyclopentanone-carboxylic acid.
- Methylmalonic acid** (*isosuccinic acid*; *ethanedicarboxylic acid*), sodium derivative of the ethyl ester, condensation of, with mesityl oxide (CROSSLEY), P., 1900, 90.
- Methylmorphimethine**, decomposition product of (PARTHEIL and GRONOVER), A., i, 516.
- isoMethylmorphol**. See 3-Hydroxy-4-methoxyphenanthrene.
- α - and β -**Methylnaphthalenes** from naphtha tar (LJUBAVIN), A., i, 23.
- Methylnaphthetetrasele** (MARCKWALD and CHAIN), A., i, 521.
- Methylnaphthatriasolyl mercaptan** (MARCKWALD and CHAIN), A., i, 521.
- Methylnaphthene**. See Methylcyclohexane.
- 2-Methyl- α -naphthiminazole**, amino-, and its sulphonic acid and diazo-compound, and hydroxysulphonic acid (GALLINER), A., i, 697.
- Methylnitramine**, physiological action of, in relation to its constitution (SPRUYT), A., i, 142.
- Methylectadienonol**, its acetate and isomeride (LÉSER), A., i, 129.
- α -Methylolbenzoic hydrazide** and its benzylidene derivative (WEDEL), A., i, 363.
- Methyloldeoxy-cinchonine** and -conchinine and their platinichlorides (KOENIGS), A., i, 190.
- Methylol-5-methyl-and-5-ethyl-acridine** (KOENIGS), A., i, 190.
- Methyloxaluric acid** (BEHREND and DIETRICH), A., i, 120.
- 1-Methylcyclopentanone**, its oxime, semicarbazone, and benzoyl derivative (BOUVEAULT), A., i, 171.
- 1-Methyl-2-cyclopentanone-1-carboxylic acid**, ethyl ester (BOUVEAULT), A., i, 171.
- 4-Methyl-3-cyclopentanone-1-carboxylic acid**, ethyl ester, and nitroso-compounds from (DIECKMANN and GROENEVELD), A., i, 297.
- Methylcyclopentanoneoxime**, action of phosphoric oxide on (WALLACH), A., i, 45.
- β -Methylcyclopentanoneisoxime** and its hydrolysis (WALLACH), A., i, 589.
- Methylpentosans**, spectrum of (WIDTSOR and TOLLENS), A., i, 244.
- Methylpentose**, isolation of, from urine (BERGELL and BLUMENTHAL), A., ii, 373.
- Methylpentoses** (SULEIMAN BEY), A., i, 377.
- Methylphenomorpholine**, colour test for (KOBERT), A., ii, 121.
- Methylphenomorpholone** (BISCHOFF), A., i, 345, 442.
- Methylphenonaphthaeridine** ("*methylnaphthaeridine*"), and its dihydro-compound and their amino-derivatives and salts, syntheses of (ULLMANN and NAEF), A., i, 360, 361, 689.
- 5-Methylphenoxazine-2:3-quinone** and its oxime (DIEPOLDER), A., i, 191.

- 2-Methyl-1:3:4:5-phenetrol**, derivatives of (KONYA), A., i, 545.
- m-Methylphenylethylamine** and its benzoyl derivative (SOMMER), A., i, 388.
- 2-m-Methylphenylethyldihydroisocindole** (SOMMER), A., i, 389.
- Methylphloroglucinol**, action of nitrous acid on, and its oximes (WEIDEL and POLLAK), A., i, 291.
- amino-derivatives of** (FRIEDL), A., i, 593.
- dibromo-**, and its triacetyl derivatives (HERZIG, POLLAK, and ROHM), A., i, 595.
- Methylpiperamide** and nitroso-, and their additive products (BAMBERGER and MÜLLER), A., i, 217.
- Methylisopilocarpine** and its salts (JOWETT), T., 853; P., 1900, 125.
- Methylpiperazine**, preparation of (ESCH and MARCKWALD), A., i, 336.
- Methylpiperidine**, action of cyanogen bromide on (V. BRAUN), A., i, 887.
- 1-Methylpiperidine**, abnormal aurichloride of (FENNER and TAFEL), A., i, 111.
- Methylisopropylaniline**, and the action of cyanogen bromide on (V. BRAUN), A., i, 642.
- 1:4-Methylisopropylbenzene**. See Cymene.
- Methylisopropylbutylsulphines**, platini-chlorides of (STRÖMHOLM), A., i, 326.
- α -Methyl-p-isopropylcinnamic acid** (GRIGOROWITSCH), A., i, 598.
- Methylisopropylcoumarones**, 3:6- and 6:3- (STOERMER), A., i, 653.
- Methyl propyl diketoxime**, diacetyl derivative of (PONZIO), A., i, 588.
- α -Methyl- β -isopropylglutaric acids** (*heptanedicarboxylic acids*) (HOWLES, THORPE, and UDALL), T., 946; P., 1900, 115.
- $\beta\beta$ -Methyl-n- and -iso-propylglutarimides**. See 2:6-Dioxy-4-methyl-4-n- and -iso-propylpiperidines.
- 3-Methyl-2-isopropylindole**, action of methyl iodide on (PLANCHER), A., i, 561.
- Methyl propyl ketone**, action of isoamyl nitrite and alcoholic hydrogen chloride on (KISSEL), A., i, 621.
- Methylisopropylquinoxaline** (PAULY and LIECK), A., i, 275.
- $\alpha\alpha$ -1-Methylpropylsuccinic acids**, *cis*- and *trans*-, preparation and dissociation constants of (BONE and SPRANKLING), T., 1302; P., 1900, 184.
- 4-Methyl-4-n- and -iso-propyltrimethylenedicarbonimides**, 3:5-dicyano- (MINOZZI), A., i, 407.
- 1-Methyl-1-propyltrimethylenedicarboxylic acid**, 2:3-dicyano- (MINOZZI), A., i, 407.
- 3-Methylpyrazole-1-p-benzoic acid**. See 1-Phenyl-3-methylpyrazole-Bz-p-carboxylic acid.
- 2-Methylpyridine-6-carboxylic acid** and its salts (LADENBURG and SCHOLTZE; PINNER; PINNER and LEWIN), A., i, 409.
- Methylpyridiniumhydroxide** (HANTZSCH and KALB), A., i, 113.
- 4-Methylpyrimidine** (*4-methyl-m-diazine*), 2- and 6-amino-, 6-chloro-, 2:6- and 6:2-chloroamino- and 6-iodo- (GABRIEL and COLMAN), A., i, 54.
- disulphide** (GABRIEL and COLMAN), A., i, 55.
- 4-Methylpyrimidine-2:6-dithiol**, **4-Methylpyrimidine-2-thiol**, 6-amino-, and **4-Methylpyrimidine-6-thiol** and 2-amino-, and its benzoyl derivatives (GABRIEL and COLMAN), A., i, 54.
- 1-Methylpyrrolidine-2-mono- and -2:2-di-carboxylic acids** (WILLSTÄTTER), A., i, 405.
- 2-Methyl-5:8-quinizarin** and its diacetyl derivative (V. NIEMENTOWSKI), A., i, 450.
- 3-Methylisoquinoline** and its tetrahydride (GABRIEL and COLMAN), A., i, 359.
- Methyl-quinolinium and -isoquinolinium hydroxides** (HANTZSCH and KALB), A., i, 113.
- Methylresorcinolacetic acid** (GILBODY, PERKIN, and YATES), P., 1900, 106.
- Methylstrophanthobioside** (FEIST), A., i, 540, 555.
- 4-Methylstyrene**, $\alpha\beta$ -di- and $\alpha\beta$:3-trichloro- (KUNCKELL and GOTSCH), A., i, 639.
- Methylsuccinic acid** (*i-pyrolartaric acid*, *citrapyrolartaric acid*, *propanedicarboxylic acid*), methylamides of (MEERBURG), A., i, 143.
- i-sodium and potassium salts** (SCHLOSSBERG), A., i, 376.
- d-N-Methyltetrahydropapaverine**. See Laudanosine.
- r-N-Methyltetrahydropapaverine** (PICHET and ATHANASESCU), A., i, 685.
- α -Methyltetronic acid**, action of diazobenzene chloride on (WOLFF and HEROLD), A., i, 585.
- N-Methyltriphenazineoxazine** and its phenylazonium base (DIEFOLDER), A., i, 192.
- Methyluracil**, imino- (GABRIEL and COLMAN), A., i, 54.
- Methyluracilcarboxylic acid**, nitro- (BEHREND and DIETRICH), A., i, 121.

- 4-Methyluric acid** (BEHREND and DIETRICH), A., i, 120; (BEHREND), A., i, 287.
- 5-Methyluric acid** and its salts and oxidation (FISCHER and ACH), A., i, 68.
- γ-Methylvaleric acid.** See *isoHexoic acid*.
- Methylvinylideneoxanilide** (v. PECHMANN and ANSEL), A., i, 287.
- Methylvioluric acid** and its salts (ANDREASCH), A., i, 479.
- 4-Methylxanthine**, decomposition of, in the organism (KRÜGER and SCHMIDT), A., ii, 31.
- Methylxanthines**, 1- and 4-, physiological action of (ALBANESK), A., ii, 424.
- Mica** from Oulx, Piedmont (COLOMBA), A., ii, 217.
- Microcline** from Japan (JIMBŌ), A., ii, 88.
- Micro-organism** from soil (STUTZER and HARTLEB), A., ii, 97.
- Microtonalite** from Cape Marsa (DUPARC and PEARCE), A., ii, 219.
- Migration constant.** See *Electrochemistry*.
- Milk**, human, caseinogen of (KOBRAK), A., ii, 420.
 urea in (SCHÖNDORFF), A., ii, 556.
 influence of alcohol on the formation of (ROSEMAN), A., ii, 225.
 Umikoff's reaction with (SIEBER), A., ii, 696.
 human and cows', comparison of the feeding of infants on (MÜLLER), A., ii, 422.
 acidity of (TOURCHOT), A., ii, 582.
 variation in total solids of (REINSCH and LÜHRIG), A., ii, 771.
 analysis of (GALLIEN), A., ii, 324; (RICHMOND), A., ii, 696.
 detection of adulteration of (TIMPE), A., ii, 251.
 detection of alkali chromates in (LEYS), A., ii, 110.
 detection of foreign colouring matters in (LEACH), A., ii, 451.
 detection of nitric acid in (UTZ), A., ii, 438.
 deceptive reactions in testing for preservatives in (AMTHOR), A., ii, 453.
 detection of salicylic acid in (SÜSS), A., ii, 770.
 detection of sodium carbonate in (SÜSS), A., ii, 759.
 simultaneous estimation of ash, fat, and residue in (TIMPE), A., ii, 179.
 estimation of fat in (TIMPE), A., ii, 179; (GALLIEN; MORINI; LEZÉ), A., ii, 324; (RICHMOND), A., ii, 696.
- Milk**, estimation of fat in condensed (LEACH), A., ii, 771.
 estimation of fat in sweetened condensed (GEISLER), A., ii, 771.
 estimation of fat in sweetened condensed, by the Babcock test (FARRINGTON), A., ii, 771.
 apparatus for the estimation of fat in (PENNY), A., ii, 770.
 modification of Duclaux's method for estimating total solids and fat in (MORINI), A., ii, 324.
 estimation of lactose in (GALLIEN), A., ii, 324.
 estimation of sucrose in condensed (GRÜNHUT and RIEBER), A., ii, 249.
 See also *Agricultural Chemistry*.
- Milk-fat**, estimation of, in dairy produce (LINET), A., ii, 451.
- Milk-sugar.** See *Lactose*.
- Mineral**, new, of the columbite group (GOODWIN and MILLER), A., ii, 662.
 new, from near Cassel (BLANCKENHORN), A., ii, 736.
- Minerals**, colours of (NABL), A., ii, 661.
 containing thorium and uranium, photographic action of (AFANASSIEFF), A., ii, 702.
 action of ammonium chloride on (CLARKE and STEIGER), A., ii, 24, 219, 414.
 from the Bogoslovsk district, Urals (v. FEDOROFF and NIKITIN), A., ii, 486.
 from the Langesund Fjord, composition of (SÖGREN), A., ii, 734.
 Moravian, composition of (KOVÁČ), A., ii, 147, 148, 149.
 from Narsarsuk, S. Greenland (FLINK), A., ii, 410.
 in the anhydrite and gypsum deposits at Oulx, Piedmont (COLOMBA), A., ii, 216.
 from the Radauthal, Harz (FROMME), A., ii, 487.
 Scottish, genesis of some (GOODCHILD), A., ii, 738.
 from the eruptive rocks of Susseava (BUTUREANU), A., ii, 149.
 in the pegmatites of the Upper Veltlin (LINCK), A., ii, 286.
- Minerals**, new. See:—
 Ancyelite.
 Angolite.
 Britholite.
 Chalcolamprite.
 Cordylite.
 Endeolite.
 Epistolite.
 Fedorowite.
 Florencite.
 Glaucochroite.

Minerals, new. See:—

Graftonite.
Hancockite.
Johnstonotite.
Lasur-oligoclase.
Leucophœnicite.
Leucosphenite.
Libollite.
Lorenzenite.
Marjaskite.
Melite.
Müllerite.
Muschketowite.
Narsarsukite.
Nasonite.
Schizolite.
Spodiophyllite.
Stokesite.
Sulvanite.
Tainiolite.
Von-Diestite.

Mineral analysis, new methods of (CARNOT), A., ii, 572.
interpretation of (PENFIELD), A., ii, 602.

substitutes for hydrochloric acid in testing for carbonates in (RICHARDS and POWELL), A., ii, 440.

Mineral oils. See Petroleum.

Mineral waters. See Water.

Minium. See Triplumbic tetroxide under Lead.

Mixtures, refraction of (PERKIN), T., 280; P., 1899, 237.

thermal conductivities of, and of their constituents (LEES), A., ii, 333.

Modulus law (PONSOT), A., ii, 392.

Molasses. See Agricultural Chemistry.

Molecular mass of sulphuric acid (LINEBARGER), A., ii, 273.

Molecular susceptibility of the paramagnetic salts of the iron group (DU BOIS and LIEBKNECHT), A., ii, 128; (LIEBKNECHT and WILLS), A., ii, 187.

of salts of the rare earths (MEYER), A., ii, 7, 186; (DU BOIS and LIEBKNECHT), A., ii, 127, 333.

Molecular volume. See Volume.

Molecular weights. See Weights.

Molluscs, acéphalous, the crystalline stalk of (COUPIN), A., ii, 420.

Molybdenum in plants (DEMARÇAY), A., ii, 235.

preparation of (ROGERS and MITCHELL), A., ii, 597.

preparation of, by the aid of liquid air (STAVENHAGEN), A., ii, 80.

Molybdenum alloys, analysis of (BORNTRÄGER), A., ii, 444.

Molybdenum dioxide (GUICHARD), A., ii, 80.

Molybdenum, blue oxide of (ROGERS and MITCHELL), A., ii, 597; (GUICHARD), A., ii, 658.

silicide (VIGOUROUX), A., ii, 144.

disulphide (GUICHARD), A., ii, 144.

sesquisulphide, Mo_2S_3 (GUICHARD), A., ii, 211.

sulphides, analysis of (GUICHARD), A., ii, 870.

Pernanganomolybdates (FRIEDHEIM and SAMELSON), A., ii, 547.

Vanadiomolybdates and Silicovanadiomolybdates (FRIEDHEIM and CASTENDYCK), A., ii, 483.

Molybdenum, estimation and separation of:—

estimation of, in iron (DÖHLER), A., ii, 691.

estimation of, in steel and steel-making alloys (IBBOTSON and BEARLEY), A., ii, 766.

separation of, from tungsten (IBBOTSON and BEARLEY), A., ii, 445.

Monkeys, effect of thyroid feeding on (EDMONDS), A., ii, 224.

Morphenol (VONGERICHTEN), A., i, 248.

Morphide, chloro-, and bromo-, and their hydrochlorides and hydrobromides (SCHRUYER and LEES), T., 1024; P., 1900, 143.

Morphine, non-nitrogenous decomposition products of (VONGERICHTEN), A., i, 248.

and its derivatives, physiological action of (WINTERNITZ), A., ii, 221, 489; (IMPENS), A., ii, 228.

derivatives, Ehrlich's diazo-reaction for the recognition of some (CACCANO), A., ii, 776.

benzyl ether (*peronine*) and ethyl ether (*dionine*), colour tests for (KOBERT), A., ii, 121.

colour test for (KOBERT), A., ii, 121.

estimation of, in organs (RUSSWURM), A., ii, 121.

isoMorphine and its hydrochloride, hydrobromide and methiodide (SCHRUYER and LEES), T., 1024; P., 1900, 143.

methiodide, action of silver sulphate and barium hydroxide on (SCHRUYER and LEES), T., 1024; P., 1900, 143.

Morphol (3:4-dihydroxyphenanthrene) (VONGERICHTEN), A., i, 248.

Mortars, change of volume of, during hydration (LE CHATELIER), A., ii, 140.

Moss-berry of Finland (STOLLE), A., ii, 614.

Mosses, chemistry of the cell membranes of (CZAPPEK), A., i, 556.

Mould, chemical action of, on butter (HANUŠ and STOCKÝ), A., ii, 772.

Moulds, replacement of potassium salts by rubidium salts in the growth of (LOEW), A., ii, 86.

influence of light on the respiration of (KOLKWITZ), A., ii, 861.

action of, on arsenic and its compounds (ABEL and BUTTENBERG), A., ii, 299.

resolution of racemic compounds by means of (ULPIANI and CONDELLI), A., ii, 493.

Mucic acid, oxidation of, in presence of ferrous salts (FENTON and JONES), T., 76; P., 1899, 224.

Mucin (LEVENE), A., i, 317.

from bone (GIES), A., i, 317.

physiological action of (LEVIN), A., ii, 295, 555.

ψ-**Mucin** from ovarian cysts (ZÄNGERLE), A., ii, 675.

Mucor Rouzii from "Chinese yeast" (WEHMER), A., ii, 743.

Müllerite from Nontron, France (ZAMBONINI), A., ii, 149.

Mulberry trees. See Agricultural Chemistry.

Muschketowite from Bogoslawsk, Urals (V. FEDOROFF and NIKITIN), A., ii, 486.

Muscle, phosphorus in (MACLEOD), A., ii, 92.

extractives of (SIEGFRIED), A., i, 127.

action of phloridzin on (LEE and HARROLD), A., ii, 558.

action of the veratrine alkaloids on (WALLER), A., ii, 425.

separation of connective tissue from (GOODMAN), A., ii, 671.

eye, effect of poisons on (GUILLERY), A., ii, 95.

heart, fat of normal and degenerated (LINDEMANN), A., ii, 32.

ventricular, action of certain ions on (LINGLE), A., ii, 739.

"surviving," action of the constant current on the respiration of (GUILLOZ), A., ii, 221.

Mustard oil from rape-cake, development and injurious effect of; and estimation of (SJOELLEMA), A., ii, 613.

Myrica Gale, constituents of (PERKIN), T., 429; P., 1900, 45.

Myricetin from various tannin matters (PERKIN), T., 423; P., 1900, 45.

Myrosin, occurrence of, in plants (BOKORNY), A., ii, 746.

N.

Naphtha, Grosny, composition of (CHARITSCHKOFF), A., ii, 147.

estimation of sulphur in (LIDOFF), A., ii, 107.

Naphtha tar, constituents of (LJURAVIN), A., i, 23.

Naphthafurans, α- and β-, bromo- and chloro-derivatives (STOERMER), A., i, 654.

β-**Naphthahydrofuran**, 1:2-dichloro- (STOERMER), A., i, 654.

1:2-**Naphtha-β-ketopentamethylene-azine** and its carboxylic and 4-sulphonic acids (THOMAS-MAMERT and WEIL), A., i, 459.

Naphthalene, vapour pressure of (ALLEN), T., 400; P., 1899, 122.

vapour in coal gas (ALLEN), A., i, 339.

derivatives, isomeric, the number of (REY), A., i, 482; (KAUFFMANN), A., i, 544.

displacement of sulphonic groups in, by nascent chlorine (VAUBEL), A., i, 544.

estimation of, in coal gas (COLMAN and SMITH), A., ii, 372.

Naphthalene, 2-chloro-, electrolytic preparation of (VOTOČEK and ZENÍSEK), A., i, 19.

1-iodoso-, and its reactions and salts (WILLGERODT and SCHLÖSSER), A., i, 282; (ORTOLEVA), A., i, 592.

1-iodoxy- (ORTOLEVA), A., i, 592.

1:5- and 1:8-dinitro-, conversion of, into nitronitrosenaphthols (GRAEBE), A., i, 24; (FRIEDLÄNDER), A., i, 150.

1:5- and 1:8-dinitro-, and 1:3:8-trinitro- (FRIEDLÄNDER), A., i, 150.

β-**Naphthalenecarboxylic acid**, ethyl ester, chloroimide of (STIEGLITZ and SLOSSON), P., 1900, 2.

1:8-**Naphthalenedicarboxylic acid**. See Naphthalic acid.

Naphthalene-1:3:5-trisulphonic acid (ERDMANN), A., i, 91.

Naphthalic acid (1:8-naphthalenedicarboxylic acid), preparation of (ANSELM and ZUCKMAYER), A., i, 175; (JAUBERT), A., i, 296.

sulphonic derivative and anhydride of, and their salts (ANSELM and ZUCKMAYER), A., i, 176.

αβ-**Naphthanthracene**, constitution of (GABRIEL and COLMAN), A., i, 232.

αβ-**Naphthanthraquinone**, constitution of (GABRIEL and COLMAN), A., i, 232.

Naphthaphenazine, 9-amino- (KEHRMANN and WOLFF), A., i, 450.

- Naphthapurpurin** (1:2:4-*trihydroxy- α -naphthaquinone*), from naphthazarin (JAUBERT), A., i, 42.
- α -Naphthaquinone**, action of nitrogen trioxide on (SCHMIDT), A., i, 299.
- 5-amino- (FRIEDLÄNDER), A., i, 150.
- dibromo-, malonic acid derivatives of (LIEBERMANN), A., i, 310.
- β -Naphthaquinone**, 3:2-chlorobromo- (HIRSCH), A., i, 670.
- α -Naphthaquinoneacetoacetic acid**, bromo-, ethyl ester, action of alcoholic potash on, and condensation of, with ethylamine (LIEBERMANN), A., i, 311.
- α -Naphthaquinone-3-acetoacetic, -3-benzoylacetic, and -3-oxalacetic acids**, 2-chloro-, ethyl esters (MICHEL), A., i, 669.
- β -Naphthaquinone-4-acetoacetic, -4-benzoylacetic, -4-malonic, and -4-oxalacetic acids**, 3-chloro-, esters of (HIRSCH), A., i, 670.
- β -Naphthaquinone-4-acetylacetone**, 3-chloro- and 3-bromo- (HIRSCH), A., i, 671.
- α -Naphthaquinone-3-acetylacetone, -3-benzoylaceton, and -3-dihydroresorcinol**, 2-chloro- (MICHEL), A., i, 669.
- β -Naphthaquinone-4-benzoylaceton, and -4-deoxybenzoin**, 3-chloro- (HIRSCH), A., i, 671.
- α -Naphthaquinone-benzoylphenylhydrazones**, -phenylbenzylhydrazones, and -phenylmethylhydrazones (McPHERSON), A., i, 124.
- β -Naphthaquinone-benzoylphenylhydrazones**, and -phenylmethylhydrazones (McPHERSON), A., i, 124.
- α -Naphthaquinonebis-1-phenyl-3-methylpyrasolons** (MICHEL), A., i, 670.
- α -Naphthaquinone-dimalonic acid and -isoidonedicarboxylic acid**, ethyl esters (LIEBERMANN), A., i, 311.
- Naphthaquinone-3-ethylacetamide**, bromo- (LIEBERMANN), A., i, 310.
- Naphthaquinoneoxalinediacetic acids** 1:2- and 2:3-, and their ethyl esters (THOMAS-MAMERT and WEIL), A., i, 459.
- Naphthatriazole** and its salts, and **Naphthatetrazole** (MARCKWALD and MEYER), A., i, 520.
- Naphthatriazole** mercaptan (MARCKWALD and MEYER), A., i, 520.
- Naphthazarin** (*dihydroxy- β -naphthaquinone*), diacetyl derivative of (THIELE and WINTER), A., i, 505.
- 1:2-Naphthasine-3:6'-disulphonic acid, sodium salt (MEIGEN and NORMANN), A., i, 702.
- 1-Naphthol, 4:5- and 4:8-dinitro- (FRIEDLÄNDER), A., i, 150.
- 5:4- and 8:4-nitronitroso-, and two isomeric *trinitro*- (GRAEBE), A., i, 24; (FRIEDLÄNDER), A., i, 150.
- β -Naphthol derivatives**, etherification of (DAVIS), T., 33; P., 1899, 210.
- α -nitroso- (MÖHLAU and STROEBACH), A., i, 368.
- Naphthols**, α - and β -, condensation of, with ethyl phenylpropionate (RUHEMANN and BEDDOW), T., 984; P., 1900, 123.
- Naphthol-X-acid, amino-**. See 8-Hydroxynaphthalene-4:6-disulphonic acid, 1-amino-.
- α -Naphtholcarboxylic acid**, methylester, nitro- and amino- (EINHORN), A., i, 441.
- α -Naphthol-2-carboxy-3-malonic acid**, ethyl ester (NEF), A., i, 23.
- β -Naphthoxyacetone** and its oxime, phenylhydrazones and semicarbazones (STOEBMER), A., i, 658.
- β -Naphthoxycinnamic acids**, α - and β - (RUHEMANN and BEDDOW), T., 984; P., 1900, 123.
- Naphthoxy-propionic, -n- and -isobutyric, and -isovaleric acids**, α - and β -, and their ethyl esters (BISCHOFF), A., i, 395.
- α -Naphthoyl- α -benzoic acid**, constitution of (GABRIEL and COLMAN), A., i, 232.
- Naphthoylbromo-ethyl- and -propylamides**, α - and β - (SAULMANN), A., i, 687.
- 1-Naphthyl iodochloride and its reactions (WILLGERODT and SCHLÖSSER), A., i, 282.
- β -Naphthyl mercaptan** (BOURGEOIS), A., i, 163.
- β -Naphthyl methyl, ethyl, and propyl ethers** and their halogen derivatives (DAVIS), T., 36; P., 1899, 210.
- 1-Naphthylamine, 4-chloro- (REVERDIN and CREPIEUR), A., i, 238.
- β -Naphthylamine derivatives**, action of aromatic aldehydes on (MORGAN), T., 1210; P., 1900, 171.
- Naphthylamines**, action of formaldehyde on (MORGAN), T., 814; P., 1900, 131.
- Naphthylcamphorformeneaminocarboxylic acids**, α - and β - (J. B. and A. TINGLE), A., i, 302.
- α - and β -Naphthylcarbamic acids, ethyl esters, and α - and β -Naphthylcarbimide (VITTENER), A., i, 154.
- Naphthylene**. See Methylcyclohexene.
- Naphthylene- α -diamines**, condensation of, with ethyl cetipate (THOMAS-MAMERT and WEIL), A., i, 459.

- Naphthylhydrazidoxalhydroxamic acids**, α - and β -, and their derivatives (THIELE and PICKARD), A., i, 30.
- β -Naphthyliminoethyl ether**, rearrangement of (WHEELER and ATWATER), A., i, 294.
- 2- α -Naphthyl-5-methylthiasoline** (SAULMANN), A., i, 687.
- Naphthylnitrosoamine** (ENGLER), A., i, 568.
- Naphthylloxazolines**, 2- α - and - β -, and their 5-methyl derivatives and their salts (SAULMANN), A., i, 687.
- Naphthylloxides**, sodium, compounds of, with the ethyl esters of α -bromo-fatty acids (BISCHOFF), A., i, 395.
- Naphthylpenthiazolines**, 2- α - and - β - (SAULMANN), A., i, 687.
- α -Naphthyl-*m*- and -*p*-phenylenediamines** (MERZ and STRASSER), A., i, 253.
- Naphthylthiazolines**, 2- α - and - β -, and their salts (SAULMANN), A., i, 687.
- Naphthylthiosulphonacetacetic acids**, α - and β -, ethyl esters (TROEGGER and EVERS), A., i, 495.
- Narcocine** and its hydrates, hydrochloride and potassium derivative, thermochemistry of (LEBOY), A., ii, 131.
- Narcotics**, anæsthetizing action of (MEYER; BAUM), A., ii, 156.
- Narcotine methiodide**, action of silver chloride on (ROSER), A., i, 51.
- Narsarsukite** from Greenland (FLINK), A., ii, 412.
- Nascent state**, influence of, on the combination of oxygen and carbon monoxide (RUSSELL), T., 361; P., 1900, 42.
- Nasonite** from New Jersey (PENFIELD and WARREN), A., ii, 89.
- Nasturtium officinale***, constituents of (GADAMER), A., i, 49.
- Natrolite**, action of ammonium chloride on (CLARKE and STEIGER), A., ii, 414.
- Neobornylamine**, separation of, from bornylamine, rotatory power of, and action of ethyl oxalate on (FORSTER and HART-SMITH), T., 1152; P., 1900, 166.
- Neodymium**, spectra of (MUTHMANN and STÜTZEL), A., ii, 18.
- carbide, preparation and properties of (MOISSAN), A., ii, 726.
- Nephritis**, excretion of alloxuric substances in (MARTIN), A., ii, 155.
- Nepodin** (HESSE), A., i, 41.
- Neroli oil** (*orange blossom oil*) (JEANCARD and SATIE), A., i, 511; (E. and H. ERDMANN), A., i, 555.
- Nerves**, properties of, under the influence of certain poisons (WEDENSKI), A., ii, 739.
- Nerves**, action of the veratrine alkaloid- on (WALLER), A., ii, 425.
- Nerve tissues**, action of the tetanus toxin on (DANYEZ), A., ii, 156.
- physiological effects of extracts of (HALLIBURTON; OSBORNE and VINCENT), A., ii, 423.
- Nervous system** of the growing rat. decrease of water in the (DONALDSON), A., ii, 556.
- "**New methylene-blue**," acyl derivative of (COHN), A., i, 455.
- Nickel**, occurrence of, in Silesia (ASCHERMANN), A., ii, 86.
- electrolytic deposition of, polarisation in the (MARSHALL), A., ii, 185.
- passivity of (HITTORF), A., ii, 706.
- specific heat of (TILDEN), A., ii, 524.
- occlusion of hydrogen by (BAXTER), A., ii, 79.
- Nickel alloys** with iron, allotropic transformations of (DUMAS), A., ii, 408.
- Nickel arsenide** (GRANGER and DIDIER), A., ii, 349.
- azoimide (CURTIUS and DARAPSKY), A., ii, 474.
- borate (OUVRARD), A., ii, 207.
- carbonyl, decomposition of, in solution (LENHER and LOOS), A., ii, 349.
- fluoride, double salts with aluminium or ferric fluoride (WEINLAND and KÖPPEN), A., ii, 143.
- phosphide, preparation of (MARON-NEAU), A., ii, 281.
- selenides (FONZES-DIACON), A., ii, 730.
- sulphate, supposed decomposition of, by light (DOBROSERDOFF), A., ii, 658.
- combination of, with ammonia in aqueous solution (DAWSON and McCRAE), T., 1247; P., 1900, 173.
- hydroxylamine compound of, crystalline form of (UHLENHUTH), A., ii, 482.
- potassium sulphate (MALLER), T., 221; P., 1899, 227.
- Nickel organic compounds** :—
- ethylenediamine compounds of (KUBNAKOFF), A., i, 209.
- Nickel**, estimation and separation of :—
- estimation of, in nickel ores (LANGMUIR), A., ii, 316.
- estimation of, in nickel-steel (SARGENT), A., ii, 51.
- estimation of, colorimetrically, in nickel-steel (FIEBER), A., ii, 628.
- separation of, from cobalt, by the action of ammonium hydroxide on the ferricyanides (BROWNING and HARTWELL), A., ii, 765.

Nickel, estimation and separation of:—
separation of, from cobalt, by means of persulphates (MAWROW), A., ii, 596, 765.

separation of, from cobalt, by means of their sulphides (TOWER), A., ii, 690.

Nickel-steel, thermo-electrical properties of (STEINMANN), A., ii, 523, 524.

estimation of nickel in (SARGENT), A., ii, 51.

estimation of nickel in, colorimetrically (FIEBER), A., ii, 628.

Nicotine, action of, on circulation and respiration (WINTERBERG), A., ii, 424.

detection of (SCHINDELMEISER), A., ii, 380.

estimation of, in tobaccos (HARKER), A., ii, 778.

estimation of, in cigars and tobacco smoke (THOMS), A., ii, 428.

i-Nicotine (PICTET and ROTSCHY), A., i, 685.

reduction of nicotyrine to (PICTET), A., i, 685.

isoNicotinic acid (4-pyridinecarboxylic acid), preparation and derivatives of (TERNÁJGÓ), A., i, 559.

2:6-diiodo- (SELL and DOOTSON), T., 235; P., 1900, 9.

Nitragin. See Agricultural Chemistry.

Nitramines, formation of, from amine nitrates (BAMBERGER and HOFF), A., i, 435.

Nitrates. See under Nitrogen and also Agricultural Chemistry.

Nitric acid, oxide and peroxide. See under Nitrogen.

Nitrification. See Agricultural Chemistry.

Nitriles, additive compounds of, with tripyridinechromium trichloride (PFEIFFER), A., i, 688.

physiological action of (FIQUET), A., ii, 424.

Nitriles. See also:—

Acetonitrile.

α -Acetylpropionitrile.

Acetylxlaronitrile.

Benzonitrile.

Benzylsulphide-*p*-dicarboxylic acid, nitrile of.

Camphocenenitrile.

Cinnamonitriles.

Crotonitrile.

p-Cyantoline.

Dihydrocampholenitrile.

Diindonemalononitrile.

Dimethylacetylacetonitrile.

$\alpha\beta$ -Dimethylglutolactonic acid, nitriles of.

Nitriles. See:—

Ethoxybenzonitrile.

B-Furfuryl- α -*p*-chlorophenylacrylonitrile.

Glycollonitrile.

Hydroxybenzonitrile.

p-Hydroxymesitylenonitrile.

Methoxybenzonitrile.

Methylacetylmalononitrile.

Phenylacetoneitrile.

α -Phenylisobutyronitrile.

Phenylcinnamonitrile.

α -Phenyl-*p*-methoxycinnamonitrile.

α -Phenylmethylenedioxycinnamonitrile.

α -Phenylnitrocinnamonitriles.

α -Phenyl-*p*-isopropylcinnamonitrile.

Propionitrile.

Propionylacetonitrile.

5-*iso*Propylheptanone-2-nitrile-7.

p-Toluenitrile.

p-Tolylisobutyronitrile.

Nitritohydroximidodisulphates (DIVERS and HAGA), T., 432; P., 1900, 54.

Nitro-compounds, cryoscopic behaviour of, in formic acid (BRUNI and BERTI), A., ii, 591.

primary or secondary, ammonium salts of, and their separation (KONOWALOFF), A., i, 324.

coloured substances derived from (HANTZSCH and KISSEL), A., i, 89;

(JACKSON and GAZZOLO), A., i, 438.

additive compounds of, with sodium hydroxide or alkylloxides (HANTZSCH and KISSEL), A., i, 89;

(JACKSON and GAZZOLO), A., i, 433; (ANGELI), A., i, 553.

aromatic, action of sodium sulphides on (BLANKSMA), A., i, 226, 482.

isoNitro-compounds, history of the (HANTZSCH), A., i, 618.

Nitrogen, atomic weight of (DEAN), T., 117; P., 1899, 213.

quinquevalent (LACHMAN), A., i, 380; (VAUBEL), A., i, 485.

isomeric partially racemic salts containing (KIPPING), T., 861; P., 1900, 51.

stereochemistry of (LE BEL), A., i, 15; (MARCKWALD), A., i, 143.

fluorescence and afterglow accompanying an electric discharge in (LEWIS), A., ii, 702.

specific gravity of, at its boiling point (DRUGMAN and RAMSAY), T., 1228; P., 1900, 172.

products of the explosion of mixtures of acetylene and (MIXTER), A., i, 618.

absorption coefficient of, by aqueous solutions of dissociating substances (BRAUN), A., ii, 529.

- Nitrogen**, solubility of, in various liquids, at low temperatures (CLAUDE), A., ii, 649.
 from albumoses (FRIEDMANN), A., i, 265.
 basic, proportion of, in elastin (EUSTIS), A., i, 817.
 the condition of, in proteids (HAUSMANN), A., i, 317.
 from the decomposition of proteids, amount of (HENDERSON), A., i, 265.
 in malt, dissolution of the (PETIT and LABOURASSE), A., ii, 611.
- Nitrogen compounds**, spectroscopic method of determining the constitution of (BRÜHL), A., i, 210.
- Nitrogen bromides**, substituted, and their relation to bromo-substituted anilides and anilines (CHATTAWAY and ORTON), A., i, 152.
- Nitrogen bromides and chlorides**, substituted (ARMSTRONG), T., 1047; P., 1900, 160; (STIEGLITZ and SLOSSON), P., 1900, 2; discussion, P., 2.
 transformation of (CHATTAWAY, ORTON, and HURLEY), A., i, 151; (CHATTAWAY and ORTON), A., i, 152, 643.
 method of transforming (CHATTAWAY and ORTON), T., 796.
 from *o*- and *p*-acetotoluidides (CHATTAWAY and ORTON), T., 789; P., 1900, 102.
 ortho-substituted, and their transformation (CHATTAWAY and ORTON), T., 797; P., 1900, 112.
- Nitrogen chlorides**, substituted (CHATTAWAY and ORTON), T., 134; P., 1899, 232.
 from *m*-chloroacetanilide (CHATTAWAY, ORTON, and HURLEY), T., 800; P., 1900, 125.
- Nitrogen iodide**, N_2I (HANTZSCH), A., ii, 274.
 $N_2H_5I_2$, preparation and properties of so-called (CHATTAWAY and ORTON), A., ii, 399.
 formation and constitution of (CHATTAWAY and ORTON), A., ii, 722.
 composition of (CHATTAWAY), A., ii, 594.
 action of light on (CHATTAWAY and ORTON), A., ii, 594.
 action of acids on (CHATTAWAY and STEVENS), A., ii, 722.
 action of alkaline hydroxides, of water, and of hydrogen peroxide on (CHATTAWAY and ORTON), A., ii, 722.
 action of reducing agents on (CHATTAWAY and STEVENS), A., ii, 399.
 ammonium iodides (HUGOT), A., ii, 274.
- Nitrogen dioxide** (*nitric oxide*), action of, on chromyl dichloride (THOMAS), A., ii, 144.
- Nitrogen tetroxide** (*nitric peroxide*), thermal conductivity of (MAGNANINI and ZUNINO), A., ii, 525.
 as a solvent (BRUNI and BERTI), A., ii, 591.
 action of, on quinonedioximes (OLIVERI-TORTORICI), A., i, 553.
- Nitrogen acids**:—
Nitric acid, formation of, during combustion (BERTHELOT), A., ii, 475, 538.
 production of, from air, by means of the electric flame (McDOUGALL and HOWLES), A., ii, 651.
 very dilute, action of, on metals (VAN BIJLERT), A., ii, 204.
 analysis of, and when mixed with sulphuric acid (VAN GELDER), A., ii, 621.
 detection of, in animal matter (VITALI), A., ii, 46.
 detection of, in milk and in water (UTZ), A., ii, 438.
 estimation of (POOL), A., ii, 107; (VAN DEVENTER), A., ii, 242.
 estimation of, in water (HÖNIG), A., ii, 242.
- Nitrates**, origin of, in caves (HESS), A., ii, 550.
 action of *Bacillus coli* and *B. d'Eberth* on (GRIMBERT), A., ii, 97.
 metallic, reduction of, by lactic acid (VANINO and HAUSER), A., ii, 722.
 See also Agricultural Chemistry.
- Nitrous acid**, affinity constant of (SCHÜMANN), A., ii, 264.
 condition of, in aqueous solutions (SAPOSCHNIKOFF), A., ii, 722.
 sulphonation of, by sulphurous acid (DIVERS and HAGA), T., 688; P., 1900, 70.
 detection and estimation of very small quantities of (ERDMANN), A., ii, 243.
 detection of, in water (ERDMANN), A., ii, 243; (SPIEGEL), A., ii, 318; (MENNICKE), A., ii, 438, 621; (SCHAEER), A., ii, 438.
 estimation of, gasometrically, in presence of nitrates or other soluble salts (GAILHAT), A., ii, 686.
 estimation of, in water (ROMIJN), A., ii, 510.
- Nitrites**, interaction between sulphites and (DIVERS and HAGA), T., 673; P., 1900, 70.

Nitrogen acids:—

Hyponitrous acid, transformation of, into hydrazine (V. BRACKEL), A., ii, 594.

Nitrogen, detection and estimation of:—
detection of, in organic compounds containing sulphur (TÄUBER), A., ii, 107.

estimation of (VILLIERS and DUMESNIL), A., ii, 310.

estimation of, by Kjeldahl's method, improved apparatus for (MEHRING), A., ii, 509.

nitric, estimation of, by Schloesing's method (DAVIDSON), A., ii, 487.

estimation of, in fertilisers containing nitrates (VEITCH), A., ii, 166.

comparative estimations of, in salt-petre (V. WISELL), A., ii, 685.

estimation of, in urine (PFAUNDLER), A., ii, 674.

estimation of ammonia and, in water, apparatus for (WESTON), A., ii, 685.

See also Agricultural Chemistry.

Nitro-group, stereochemical behaviour of the (WDEKIND), A., i, 216.

elimination of a, during diazotisation (MELDOLA and WECHSLER), T., 1172; P., 1900, 167.

direct introduction of a, into the side chain of aromatic amines (BAMBERGER and HOFF), A., i, 435.

rate of substitution of, by an alkoxyl (DE BRUYN), A., i, 146.

Nitrohydroxylaminic acid and its salts (ANGELI and ANGELICO), A., ii, 594, 722.

"Nitroic acids" (HANTZSCH and KISSEL), A., i, 89; (ANGELI), A., i, 552.

Nitroprussides, detection of, in cases of poisoning (VENTUROLI), A., ii, 174.

Nitrosates (IPATIEFF and SOLONINA), A., i, 3.

Nitrosamines of methylated nitroanilines (BAMBERGER and MÜLLER), A., i, 217.

Nitroso-compounds from 2-ketocarboxylic esters (DIECKMANN; DIECKMANN and GROENEVELD), A., i, 297.

reaction of (ANGELI and ANGELICO), A., ii, 722.

aromatic, condensation of, with methylene derivatives (SACHS), A., i, 362.

fatty, preparation of (SCHMIDT), A., i, 332.

Nitrosyl chloride, action of, on organic compounds containing a double linking (IPATIEFF and SOLONINA), A., i, 14.

Nitrosyl chloride and its compounds with antimony, iron and tin chlorides (VAN HETEREN), A., ii, 187.

Nodes. See Agricultural Chemistry.

Nonaldehyde from German rose oil (WALBAUM and STEPHAN), A., i, 677.

Nopinone (WALLACH and SCHÄFER), A., i, 241.

Norpic acid from verbenone (KERSCHBAUM), A., i, 353.

Nortropan (norhydrotropidine) and its iminochloride (WILLSTÄTTER and IGLAUER), A., i, 458.

Nortropidine and its chloro-derivative (WILLSTÄTTER and IGLAUER), A., i, 458.

Nucleic acid from various sources, formula of (HERLANT), A., i, 466.

from salmon milt (SCHMIEDBERG), A., i, 267.

of the wheat germ (OSBORNE and CAMPBELL), A., i, 573.

solubility of uric acid in (KOSSEL and GOTO), A., ii, 421; (GOTO), A., ii, 740.

Nucleic acids, preparation of (LEVENZ), A., i, 572.

Nucleic acids, α - and β - , and Nucleothymic acid, preparation of (NEUMANN), A., i, 319.

Nuclein, metabolism of (LOEWI), A., ii, 417.

Nucleins, combination of, with metals, alkaloids, and toxins (STASSANO), A., ii, 559.

metabolism of (MILROY and MALCOLM), A., ii, 91.

Nucleons (KRÜGER), A., i, 128.

Nux vomica, composition of the albumen of (BOURQUELOT and LAURENT), A., ii, 498.

O.

Oats. See Agricultural Chemistry.

Obituary notices:—

Peter Waage, T., 591.

William Harkness, T., 592.

J. F. Hodges, T., 593.

William Marcet, T., 594.

George Henry Ogston, T., 594.

Robert Oxland, T., 595.

Richard Tayler Plimpton, T., 595.

Henry Charles Reynolds, T., 596.

Edward C. Cortis Stanford, T., 597.

Sidney Augustus Sworn, T., 598.

William Thorp, T., 599.

Johann K. F. Ferdinand Tiemann, T., 600.

David Watson, T., 603.

- Oceanic salt deposits, formation of** (VAN'T HOFF and MEYERHOFFER), A., ii, 12, 23; (VAN'T HOFF and DAWSON), A., ii, 76; (VAN'T HOFF and CHIARAVIGLIO; VAN'T HOFF and KASSATKIN), A., ii, 284; (WILSON), A., ii, 285; (VAN'T HOFF and ARMSTRONG), A., ii, 531.
- n-Octane, vapour pressures, specific volumes, and critical constants of** (YOUNG), T., 1145; P., 1900, 166.
- Octane (diisobutyl), preparation, vapour pressures, specific volumes, and critical constants of** (YOUNG and FORTY), T., 1126; P., 1900, 165.
- Octanedicarboxylic acids. See:—**
Dipropylsuccinic acids.
Propylisopropylsuccinic acids.
- Octazones. See: Bisdiazotetrazones.**
- $\gamma\delta$ -isooctonic acid and isooctolactone** (FROMM), A., i, 402.
- Octenoic acid ($\gamma\delta$ -dimethyl- β -hexenoic acid), and its ethyl ester** (BLAISE), A., i, 330.
- Octoaspartide and its combinations with amines** (SCHIFF), A., i, 279.
- Octahydro-acridine- and -xanthenediones and their oximes** (VORLÄNDER and KALKOW), A., i, 99.
- β -Octylamine, and the action of silver oxide on bromo-** (KIJNER), A., i, 278.
- Octylhydrazine and its compound with phenylthiocarbimide** (KIJNER), A., i, 278.
- Oil cakes. See Agricultural Chemistry.**
- Oils, lubricating, decomposition of, by distillation under pressure** (KRAEMER and SPILKER), A., i, 617.
mineral. See Petroleum.
vegetable, composition and constants of (SCHIMMEL and Co.), A., i, 184.
viscosity of (DOWZARD), A., i, 676.
analysis of (SOLDAINI and BERTÉ), A., ii, 173.
- Welmans' phosphomolybdate test for the detection of** (WELMANS; SOLT-SIEN), A., ii, 697.
- improved absorption apparatus for use in the analysis of** (CHAPMAN and BURGESS), A., ii, 693.
- Bechi and Halphen's colour tests for cotton-seed oil in** (RAIKOW and TSCHERWENIWANOW), A., ii, 252.
- estimation of carvone in** (LABBÉ), A., i, 398; (ALDEN and NOLTE), A., ii, 117; (ALDEN and EHLEBT), A., ii, 631.
- estimation of, in essences** (WENDER and GREGOR), A., ii, 767.
- rancidity of** (NAGEL), A., i, 271.
- analysis of, refractometrically** (PAR-THEIL and V. VELSEN), A., ii, 633.
- Oils, estimation of the acetyl value of** (LEWKOWITSCH), A., ii, 323.
estimation of the bromine absorption of (MCILHINEY), A., ii, 178, 633.
bromine and iodine values of (WILLIAMS), A., ii, 633.
estimation of the iodine method for (GILL and ADAMS; LEWKOWITSCH), A., ii, 323; (WIJS; MARSHALL), A., ii, 376.
- Oils. See also:—**
Abies canadensis, oil from.
Abies pectinata, oil from.
Aralia nudicaulis, oil from.
Bean oil.
Bergamot oil.
Bitter orange oil.
Carthamus tinctorius, oil from.
Cascarilla oil.
Chrysanthemum japonicum, oil from.
Citronella oil.
Colophony oil.
Corn oil.
Cotton-seed oil.
Fir-wood, oil of.
Fish oil.
Geranium oil.
Ginger oil.
Glycyrrhiza glabra, oil from.
Hazel-nut oil.
Jasmine oil.
Juniper oil.
Kaempferia Galanga, oil of.
Larix decidua, oil from.
Lavender, oil of.
Lemon oil.
Linseed oil.
Macassar oil.
Maize oil.
Mandarins, oil of.
Mentha piperita, oil of.
Mustard oil.
Neroli oil.
Olive oil.
Parsley oil.
Petit-grain, oil of.
Poplar-bud oil.
Roses, oil of.
Safflower oil.
Sandalwood oil.
Savin, oil of (*oleum sabinae*).
Sesamé oil.
Telfairia oil.
Turpentine, oil of.
Wheat germ, oil from.
- Olefines, velocity of formation of** (BARR-SOFF), A., i, 322.
- Oleic acid, commercial and purified** (DIRTZ), A., ii, 632.
action of dilute nitric acid on (EDMED), P., 1899, 190.

- Oleic acid**, reduction of, to stearic acid by the aid of nascent hydrogen (FREUNDLICH and ROSAUER), A., i, 581.
 estimation of, in olive oil (MOORE), A., ii, 376.
 separation of, from other fatty acids (LEWKOWITSCH), A., ii, 376; (FARNSTEINER), A., ii, 767.
- Olive oil**, estimation of free fatty acid in (MOORE), A., ii, 376.
- Olives**. See Agricultural Chemistry.
- Olivine** from Japan (JIMBÔ), A., ii, 87.
 from Latium (ZAMBONINI) A., ii, 149.
 pseudomorphs after, from the Urals (V. JEREMÉEFF), A., ii, 354.
- Opianic acid**, thermochemistry of (LEBOY), A., ii, 261.
- Opium**, assay of (NAGELVOORT; GORDIN), A., ii, 777.
 detection of (MECKE), A., ii, 180.
- Opoponax**, examination of (DIETERICH), A., ii, 118.
- Optical isomerides**, solidification and transition phenomena of (ADRIANI), A., ii, 462.
 melting points in systems of (ROOZEBOOM), A., ii, 64.
- Orange**, bitter, oil of, properties of (SOLDAINI and BERTÉ), A., ii, 173.
- Orange blossom oil**. See Neroli oil.
- Oreinalbis- α -oxy-propionic-, -butyric, and -isovaleric acids** and their ethyl esters (BISCHOFF), A., i, 446.
- Oreinalol** (3:5-dihydroxytoluene), condensation of the disodium derivative of, with esters of α -bromo-fatty acids (BISCHOFF), A., i, 446.
 nitroso- and its methyl ether (FARMER and HANTZSCH), A., i, 103; (HENRICH), A., i, 163, 436.
- Oreinaltricarboxylic acid**, methyl and ethyl esters, formation, constitution and nitration of (DOOTSON), T., 1198; P., 1900, 170.
 nitro-, hydrolysis of the methyl ester, and reduction of the methyl and ethyl esters of (DOOTSON), T., 1199; P., 1900, 170.
- Ores**, detection of minute quantities of gold in (DÖRING), A., ii, 371, 445.
 estimation of alumina as phosphate in (CAMP), A., ii, 763.
 New Caledonian, estimation of cobalt in (MOORE), A., ii, 764.
 containing arsenic, estimation of phosphorus in (CAMP), A., ii, 767.
 estimation and separation of antimony and arsenic in (BECK and FISHER), A., ii, 312.
 estimation of sulphur in (TRUCHOT), A., ii, 309.
- Organic compounds**, electro-synthesis of (DONY-HÉNAULT), A., i, 577; ii, 644.
 supposed negative heat of formation of some (VAUBEL), A., ii, 274.
 open- and closed chain, influence of the side-chain on the properties of (MENSCHUTKIN), A., i, 335, 341.
 oxidation of, with alkaline potassium permanganate (DONATH and DITZ), A., i, 197.
 simultaneous oxidation and hydration of, under the influence of light and oxygen (BERTHELOT), A., i, 3.
 containing a double linking, action of nitrosyl chloride on (IPATIEFF), A., i, 14.
 destruction of, in the detection of metals (GRAS and GINTL), A., ii, 111.
 containing nitrogen, analysis of (BENEDICT), A., ii, 439.
 containing sulphur, detection of nitrogen in (TAUBER), A., ii, 107.
 estimation of elements in (BERTHELOT; VALEUR), A., ii, 172.
 estimation of phosphorus in (MARIE), A., ii, 108.
- Organic substances**, estimation of sulphur in (HENRIQUES), A., ii, 107.
 estimation of zinc in (LEHMANN), A., ii, 170.
- Organism**, syntheses in the (HILDEBRANDT), A., i, 686; ii, 676.
 action of hamatoxin on the (METCHNIKOFF and BESBEDKA), A., ii, 741.
 formation of acetone in the (WALDVOGEL), A., ii, 153.
 arsenic in the (GAUTIER), A., ii, 152, 226.
 a reducing and hydrogenating enzyme in the (ABELOUS and GÉRARD), A., ii, 226.
 reducing and oxidising enzymes in the (ABELOUS and GÉRARD), A., i, 268.
 formation of fat in the, by intensive feeding of fat (HENRIQUES and HANSEN), A., ii, 668.
 occurrence of lactic acid in the, in arsenical poisoning (MORISHIMA), A., ii, 295.
 origin and excretion of oxalic acid in and from the (SALKOWSKI), A., ii, 740.
 formation and decomposition of uric acid in the (WIENER), A., ii, 153.
 behaviour of glucosamine hydrochloride in the (OFFER and FRÄNKEL), A., ii, 294.
 influence of proteids on the (PFLÜGER), A., ii, 91.
 action of saps in the (MUNK), A., ii, 418.

Organism, defence of the, against the toxic properties of glandular secretions (CHARRIN and LEVADITI), A., ii, 224.
 detection and estimation of arsenic in the (GAUTIER), A., ii, 168; (SCHERBATSCHOFF), A., ii, 622.
Organo-metallic compounds. See:—
 Acetylene cuprous and potassium chlorides.
 Allenmercury salts.
 Benzenediazonium nitrate mercurinitrite.
 Benzene-mono- and -tri-dimetaphosphoric acid.
 Boric acid esters.
 Butanolmercury salts.
 Butenmercury iodide.
 Dianilinoorthophosphoric acid.
 Dianilinophosphoryl chloride.
 Di-*p*-phenetidinophosphoric acid.
 Diphenylcarbazone metallic derivatives.
 Ethanolmercury salts.
 Ethenmercury salts.
 Ethyl ether mercury chloride.
 Hydroxymercuribenzoic acid.
 Mercarbide.
 Mercuriacetic acid.
 Mercuribenzoic acid.
 Mercuricrotonic acid.
 Mercurilævulic acid.
 Mercurisalicilic acid.
 Mercurioheptanaphthene iodide.
 Mercurydiethyl.
 Mercurydimethyl.
 Mercurydiphenyl.
 Methyl ethyl propyltin salts.
 Osmyloxalic acid.
 Oxymethylphosphoric acid.
 Palladobisphenylammonium salts.
 Palladodi-piperidium and -quinolium chlorides.
 Pallado-oxalic acid.
 Phosphoxyanilides.
 Platosemiallyl alcohol.
 Platosemiethylene chlorides.
 Propanolmercury salts.
 Propenolmercury salts.
 Salicylhydramide copper derivatives.
 Tetraethylphosphonium compounds.
 Tetraethylstibonium salts.
 Tetramethylphosphonium compounds.
 Tetrapropylstibonium salts.
 Trimercuriacetic acid.
 Tripropylenediaminechromium iodide.
 Tripyridinechromium trichloride.
 Tungsten alkyls.
 Zinc ethyl.
Organs, estimation of uric acid and purine bases in (HIS and HAGEN), A., ii, 769.

Orientation, influence of various groups on (LAPWORTH), P., 1900, 108.
 of chromophores, influence of, on the colour and other properties of dyes (REVÉRDIN and CRÉPIEUX), A., i, 701.
Orthocase from Japan (JIMBÔ), A., ii, 88.
 from Russia (TARASSENKO), A., ii, 26.
Oxazones, solubility of (NEUBERG), A., i, 410.
Osmium sulphite and chlorosulphite, compounds of, with sodium and potassium (ROSENHEIM), A., ii, 660.
Osmyloxalic acid, salts of (WINTREBERT), A., i, 548.
Osmotic pressure. See Diffusion.
Osones, formation and isolation of (MORRELL and CROFTS), T., 1219; P., 1900, 171.
Ovarian cysts, ψ -mucin from (ZÄNGERLE), A., ii, 675.
Ovaries, extract of, influence of, on the excretion of urea during pregnancy (CHARRIN and GUILLEMONAT), A., ii, 554.
Ovum, action of increased osmotic pressure on the (BATAILLON), A., ii, 554.
Oxalacetic acid, preparation, properties and reactions of (FENTON and JONES), T., 77; P., 1899, 224.
 formation of (DENIGES), A., i, 204.
 formation of, by the oxidation of tetracetic acid (FITTIG), A., i, 375.
Oxalidacetic acid. See Cetipic acid.
Oxalic acid, formation of (DENIGES), A., i, 204; (SABBATANI), A., i, 587.
 formation of, from dehydrohomocamphoric acid (LAPWORTH), T., 1076.
 oxidation of, by potassium permanganate (v. GEORGIEVICS and SPRINGER), A., ii, 631.
 influence of catalytic agents on the oxidation of solutions of (JORISSEN and REICHER), A., ii, 200.
 origin and excretion of (SALKOWSKI), A., ii, 740.
 estimation of, in beet leaves (BÜLOW), A., ii, 322.
 estimation of, in urine (SALKOWSKI), A., ii, 635.
Oxalic acid, cerium salt, composition and estimation of (POWER and SHEDDEN), A., ii, 628.
 crystalline manganese salt (DENIGES), A., i, 274.
 and its salts, osmyl derivatives of (WINTREBERT), A., i, 543.
 pallado-derivative of (LOISELEUR), A., i, 542.

Oxalic acid, ethyl ester, condensation of, with ethyl crotonate (LAPWORTH), P., 1900, 132.
 condensation of, with acetonyl-acetone (GRAY), A., i, 376.
 γ -Oxalocrotonic acid, ethyl ester (LAPWORTH), P., 1900, 132.
Oxaluria, alimentary (PIRALLINI), A., ii, 492.
Oxaluric acid, occurrence of, in urine (SALKOWSKI), A., ii, 685.
Oxamide, dithio- (*rubeanic acid*), condensation of, with aldehydes and secondary bases (WALLACH), A., i, 210.
Oxazine dyes, constitution of (KEHRMANN), A., i, 61; (GREEN), A., i, 119.
isoOxasoles, formation of (DUNSTAN and GOULDING), T., 1266; P., 1900, 174.
Oxidation, theory of (HABER; HABER and BRAN), A., ii, 720.
 phenomena of (ENGLER and WEISSBERG), A., i, 399.
 influence of catalytic agents on (JORISSEN and REICHER), A., ii, 200.
 with free oxygen (OSTWALD), A., ii, 592.
 with atmospheric oxygen (BILTZ), A., i, 662.
 spontaneous, and formation of active oxygen (MANCHOT), A., i, 300.
 of the nature of dehydrogenation by means of ferricyanides (ÉTARD), A., i, 301.
 in animal tissues (MEDVEDEFF), A., ii, 738.
Oxidizing agents, effect of, on the reduction of mercuric and thallic chlorides by oxalic acid (KASTLE and BEATTY), A., ii, 627.
Oxime from the acid $C_{13}H_{15}O_5$ (VORLÄNDER and KALKOW), A., i, 99.
 from the aldol from isobutaldehyde and formaldehyde (WESSELY), A., i, 428.
 from the condensation of benzyl cyanide and ethyl fumarate (HENZE), A., i, 347.
 $C_4H_5O_3N_3$, from hydroxylamine hydrochloride and dihydrodiazotetronic anhydride (WOLFF and LÜTTINGHAUS), A., i, 584.
 (m. p. 82°) from the ketone $C_{10}H_{16}O$ from isofenchyl alcohol (BERTRAM and HELLE), A., i, 399.
 $C_{15}H_{15}O_4N$, and $C_{15}H_{15}O_3N$ (POND, MAXWELL, and NORMAN), A., i, 102.
Oximes, action of Caro's reagent and of nitrogen tetroxide on (BAMBERGER), A., i, 500.
 oxidation of (HARRIES), A., i, 504.

Oximes. See also :—
 Acetaldoxime.
 Acetoxime.
 1-Acetylcoumarone, oximes of.
 Aldehyde-musk, oximes of.
 Allylacetone, oxime of.
 Amygdalinamidoxime.
p-Anisaldoximes.
 Benzaldoxime.
 Benzenylanilinoxime.
β-Benzildioxime.
 Benzoylusic acid, oxime of.
 Benzylbenzenylaminooxime.
 Benzylchloroformoxime.
 Benzylideneacetoxime.
 isoButylideneacetone, oxime of.
 Butylxylylaldehyde, oxime of.
 isoButyralacetone, oxime of.
 Camphenyloneoximes.
 Camphonic acid, oxime of.
 Camphononic acid, oxime of.
 Camphordioximes.
 Camphorone, oxime of.
 Camphoroxime.
 Carvoxime.
 Chrysoquinoneoxime.
 Dehydracetic acid, oximes of.
 Diacetonephenylthiocarbamidoxime.
 Diacetyldioxime.
 Dibenzylideneacetonehydroxylamine-oxime.
 Dibenzylideneacetoneoxime.
o-Diethoxydiphenyltetrahydropyrene-oxime.
 Diethylacetoxime.
 Dihydroazthiotetride-4-aminooxime.
 α -Diketoximes.
o-Dimethoxydiphenyltetrahydropyreneoxime.
 3:5-Dimethoxyquinoneoximes.
 3:5-Diphenylisooxazoloxime.
 1:2-Diphenyltetrahydro-*β*-naphthenoneoxime.
 Diphenyltetrahydropyreneoxime.
 6-Ethoxyflavanoneoxime.
 Ethylethloroiso-propylketoxime.
 7-Ethylisoresindoneoxime.
 Formoximes.
 Glycollic aldoxime.
 Guaiscol, isonitroso-
*cyclo*Heptanoneisooxime.
*cyclo*Hexanoneisooxime.
 α -Hydroxybutaldoxime.
 3-Hydroxy-5-methoxy-2-methyl-*p*-quinone-4-oxime.
 Hydroxynaphthaloxime.
 Hydroxy-*o*-tolualdehydes, oximes of.
 Iminodicarboxylic acid, oxime of.
 Indoneoxime.
 Jasmoneoxime.
 Ketohydroxytriphenyltetrahydrobenzene, oxime of.

Oximes. See:—

- Ketoximes.
 2:6-Lutidyl acetonyl sulphide, oxime of.
 Menthoneisoxime.
 Mesityloxime.
 Mesoxamidoxime.
 4'-Methoxy-6-athoxyflavanoneoxime.
 Methylethylacetoxime.
 Methyl furfuryl ketone, oxime of.
 Methylheptenoneoxime.
 Methylcyclohexanoneoximes.
 Methylcyclopentanoneoximes.
 5-Methylphenoxazine-2:3-quinone-oxime.
 Methylphloroglucinol oximes.
 β -Naphthoxyacetoneoxime.
 Octohydroacridinedione, oxime of.
 Octohydroxanthenedione, oxime of.
 Orcinol, nitroso-oximinacetone.
 β -Oximinobutyrolactone.
 $\beta\delta$ -Oxy- β -methyl- η -octene- ζ -one oxime.
 Phenolphthalein, oxime of.
 Phenoxypropaldoxime.
 Phenylbenzenylaminoxime.
 Phenyl-*p*-tolenylaminoxime.
 Phloroglucinol methyl ethers, oximes of.
 Phthalaldehyde dioxime.
 Pinacolin dioxime.
 Pinenoneoxime.
*iso*Propyl butyl ketone, oxime of.
 Pyridineacetophenoneoxime.
 Pyrrolealdoxime.
 Pyruvamide, oxime of.
 Quinoneoximes.
*iso*Rosindoneoxime.
*apo*Safranoneoxime.
 Santaloneoxime.
 Santic acid, dioxime of.
 Strychnine, *tetrachloro*-, oxime of.
 Suberoneisoxime.
 Thujaketoneoxime.
 Thymoquinoneoximes.
 Toluquinoneoxime.
 Tolyloxyacetone, oxime of.
 Tolyloxypropaldehyde, oximes of.
 7-*o*-Tolyloisroindoneoxime.
 Triketosantic acid, dioxime of.
 Usnic acid, oximes of.
 Xylenoxyacetone, oximes of.
 Xylenoxyaldehyde, oxime of.
 Xylooxime.
- Oximinacetone** as a pseudo-acid (FARMER and HANTZSCH), A., i, 103.
- α -Oximine-adipic and -pimelic acids** from cyclic 2-ketocarboxylic esters (DIECKMANN; DIECKMANN and GROENEVELD), A., i, 297.

- β -Oximinobutyrolactone** (WOLFF and LÜTTRINGHAUS), A., i, 584.
- α -Oximinoketones** as pseudo-acids (FARMER and HANTZSCH), A., i, 103.
- α -Oximine- β - and - γ -methyladipic acids** (DIECKMANN and GROENEVELD), A., i, 297.
- Oximinophenylacetoneitrile**, *p*-chloro- (V. WALTHER and WETZLICH), A., i, 438.
- Oximinopropionic acid**, hydroxamic acid of (WHITELEY), T., 1040; P., 1900, 145.
- Oxyazo-compounds**, constitution of (FARMER and HANTZSCH), A., i, 122.
- bromination of (ARMSTRONG and ISHERWOOD), P., 1900, 158.
- Oxybassorin** (HILGER and DREYFUS), A., i, 379.
- o*-Oxycarbanil and its ethers**, absorption spectra of (HARTLEY, DOBBIE, and PALIATSEAS), T., 839; P., 1900, 130.
- Oxycelluloses**, two, from cellulose (NASTUKOFF), A., i, 540.
- from cotton, flax, hemp, and rhea (VIGNON), A., i, 628.
- acetyl derivatives of (VIGNON and GERIN), A., i, 629.
- nitro- (VIGNON), A., i, 589, 629.
- Oxycobaltamine thiocyanates** (MASCETTI), A., i, 541.
- Oxycetarine**, and its bromo-derivative and salts (WULFF), A., i, 607.
- Oxydiethylenedisulphidedibromomethylsulphine** and its salts (STRÖMHOLM), A., i, 14.
- Oxydiethylenedisulphidemethylsulphine salts**, and the action of chlorine on (STRÖMHOLM), A., i, 326.
- Oxydiethylenedisulphidethetine** and its salts (STRÖMHOLM), A., i, 18.
- 5-Oxy-1:4-dimethyl-6:7-dihydropurine**. See Deoxytheobromine.
- 5-Oxy-1:4-dimethylpurine** and its derivatives (TAFEL; BAILLIE and TAFEL), A., i, 121.
- 2-Oxy-3-ethylpurine** and 5:7-dichloro- and iodo-, and their salts (ARMSTRONG), A., i, 636.
- Oxygen**, evolution of, at the anode in the electrolysis of alkali chloride solutions (FOERSTER and SONNEBORN), A., ii, 645.
- evolution of, from chlorates (SODERF), T., 137, 717; P., 1899, 157; 1900, 88.
- cause of the evolution of, when oxidisable gases are absorbed by permanganic acid (MORSE and BYERS), A., ii, 406.

Oxygen, specific gravity of, at its boiling point (DRUGMAN and RAMSAY), T., 1228; P., 1900, 172.
 solubility of, in various liquids, at low temperatures (CLAUDE), A., ii, 649.
 influence of the nascent state on the combination of carbon monoxide and (RUSSELL), T., 361; P., 1900, 42.
 influence of finely divided platinum on the combination of hydrogen and (FRENCH), A., ii, 718.
 combination of, with sulphur dioxide (RUSSELL and SMITH), T., 340; P., 1900, 41.
 the rendering, active (ENGLER), A., i, 399.
 active, formation of, in oxidation processes (MANCHOT), A., i, 300.
 atmospheric, oxidation with (BILTZ), A., i, 662.
 oxidation of potassium cobaltocyanide and of chromous salts by (MANCHOT and HERZOG), A., ii, 546.
 oxidations with free (OSTWALD), A., ii, 592.
 in human blood (LOEWY), A., ii, 357.
 absorption of free, by normal urine (BERTHELOT), A., ii, 740.
 estimation of, in copper, by ignition in hydrogen (ARCHBUTT), A., ii, 756.
 estimation of, in water (MUTSCHLER), A., ii, 106; (ZETSCHE), A., ii, 166.
 estimation of dissolved, in fresh-water, sea-water, sewage effluents, etc. (LETTS and BLAKE), A., ii, 755.
Oxyglutin, formation of (SACHAROFF), A., i, 268.
Oxyhæmoglobin. See under Hæmoglobin.
Oxyhydroditeressantialic acid (MÜLLER), A., i, 678.
Oxymethyl, *di*- and *tri*-bromo-, acetyl derivatives of (AUWERS and BROICHER), A., i, 162.
Oxymethyleneamphor, tautomerism of (BRÜHL), A., i, 497.
 β -Oxy- β -methyl- η -octene- ζ -one and its oxime and acetyl derivative (LÉSER), A., i, 130.
Oxymethylphosphoric acid (POSTERNAK), A., ii, 679.
2-Oxy-3-phenylpurine, 5:7-dichloro- (FISCHER), A., i, 417.
Oxyprotein (SCHULZ), A., i, 266.
5-Oxy-1:4:6-trimethyl-6:7-dihydropurine. See Deoxycaffeine.
Oxy-p-2-xyleneol, 8:5:6-*tri*- and *iso*:3:5:6-*penta*-bromo- and their acetyl derivatives (AUWERS and BROICHER), A., i, 162.

VOL. LXXVIII. ii.

Ozone, formation of, by a point-discharge in oxygen (WARBURG), A., ii, 721.
 production of, by the decomposition of water by fluorine (MOISSAN), A., ii, 13.
 apparatus for exhibiting the production of (TECLU), A., ii, 72.
 molecular weight of (LADENBURG), A., ii, 721.
 estimation of (TECLU), A., ii, 437; (BRUNCK), A., ii, 572.
 estimation of, from ozonisers (ACKERMANN), A., ii, 509.

P.

Pachyrhizide, a fish poison and its anhydride (VAN SILLEVOLDT), A., i, 109.
Palladium, atomic weight of (HARDIN), A., ii, 85.
Palladous ammonium trichlorosulphite (ROSENHEIM and ITZIG), A., ii, 282.
 potassium iodonitrite (ROSENHEIM and ITZIG), A., ii, 282.
Palladium organic compounds:—
Palladium, ethylenediamine compounds of (KURNAKOFF and GWOSDAREFF), A., i, 209.
Palladous potassium oxalonitrite (ROSENHEIM and ITZIG), A., ii, 282.
Pallado-bisphenylammonium chloride and bromide, -dipiperidium and -diquinolinium chlorides (HARDIN), A., ii, 85.
Pallado-oxalic acid and its salts (LOISELEUR), A., i, 542.
Palladium, detection of:—
 new microchemical test for (POZZI-ESCOFF and COUQUET), A., ii, 371.
Palladium black, action of a mixture of benzene vapour and hydrogen on (LUNGE and AKUNOFF), A., i, 543.
Palladium hydrogen, nature of (SHIELDS), A., ii, 215.
Palm kernels. See Agricultural Chemistry.
Pancreas, secretion of the (WALTER), A., ii, 558.
 autodigestion of the (PFÖRRINGER), A., ii, 28.
 glycolytic action of the (PIRELLINI), A., ii, 420.
 lactase of the (WEINLAND), A., ii, 93.
Pancreatic juice, influence of bile, of acid, and of alkalis on the proteolytic action of (RACHFORD), A., ii, 91.
Pancreatin, action of papain on (HARLAY), A., i, 468.
Papain, action of heat on (HARLAY), A., i, 420.

- Papain**, action of, on gelatin (SACHAROFF), A., i, 268.
 action of, on pepsin and pancreatin (HARLAY), A., i, 468.
 digestion of albumin and fibrin by (HARLAY), A., i, 419.
- Parabanic acid** (*oxalylcarbamide*), synthesis of (CAZENEUVE), A., i, 144.
- Parachymosin** and **chymosin** (BANG), A., ii, 356.
- Paraffins**, nitro-, new method for the preparation of (AUGER), A., i, 578.
 electrical conductivity of sodium derivatives of (SULC), A., ii, 332.
 action of alkalis on, and reduction of, and of their salts (DUNSTAN and GOULDING), T., 1266; P., 1900, 175.
 action of zinc alkyls on (BEWAD), A., i, 629.
 reactions of (HANTZSCH and KISSEL), A., i, 90.
- Paraformaldehyde**. See under **Formaldehyde**.
- Paramucosin** (LEATHES), A., i, 818.
- Paranelecin** from casein, phosphorus in (JACKSON), A., ii, 606.
- Parannucleo-compounds**, chemistry of (LEVENE and ALSBERG), A., ii, 555.
- Parapropaldehyde**. See **Propaldehyde**.
- Paraxanthine**. See **Xanthine**.
- Paris-green**, estimation of arsenic in (SMITH), A., ii, 47; (HAYWOOD; HILGARD), A., ii, 758.
- Parasite** from Greenland (FLINK), A., ii, 410.
- Paraleyl oil**, constituents of (BIGNAMI and TESTONI), A., i, 400.
- Parasip**. See **Agricultural Chemistry**.
- Parthenogenesis**, artificial (LOEB), A., ii, 555, 608; (VIGNIER), A., ii, 608.
- Passivity** of metals (HITTORF), A., ii, 705.
- Pastry**, examination of commercial (JUCKENACK; BEIN), A., ii, 460.
- Pears**, distribution of sugar, acid, and tannin in (KELHOFER), A., ii, 497.
- Pear trees**. See **Agricultural Chemistry**.
- Peas**. See **Agricultural Chemistry**.
- Peat**, accumulation of iron in (VAN BEMMELEN), A., ii, 215.
- Peat-meal molasses**. See **Agricultural Chemistry**.
- Peat soil**. See **Agricultural Chemistry**.
- Pectolite** from New Jersey (CLARKE and STEIGER), A., ii, 24.
 action of ammonium chloride on (CLARKE and STEIGER), A., ii, 24, 414.
- Pegmatites** of the Upper Valtin, minerals in (LINCK), A., ii, 286.
- Péligot's absorption apparatus**, improvement in (PANNERTZ), A., ii, 621.
- Pentacetoxy- β -naphthalene** (THIELE and WINTER), A., i, 505.
- Pentacetyl**. See under the **Parent Substances**.
- cycloPentadiene**, ketone reactions of (THIELE), A., i, 298.
 physiological action of (ELFSTRAND), A., ii, 423.
- Pentaglycol**. See **Dihydroxydimethylpropane**.
- Pentahydroxynaphthaquinone** and its pentacetyl derivative (THIELE and WINTER), A., i, 505.
- Pentamethylbenzhydrol** and its acetyl derivative (WEILER), A., i, 214.
- 3:5:3':4':6'-Pentamethyldiphenylmethane**, synthesis of (WEILER), A., i, 213, 284.
- Pentamethylene derivatives**, new series of (PERKIN, THORPE, and WALKER), P., 1900, 149.
 See also **cycloPentane**.
- Pentamethylenehexacarboxylic acid** (BOTTOMLEY and PERKIN), T., 294; P., 1900, 16.
- Pentamethylene-1:3:4-tricarboxylic acid**, *cis*- and *trans*-, synthesis of (BOTTOMLEY and PERKIN), T., 296; P., 1900, 16.
- Pentamethyloctohydro-xanthenedione** (VORLÄNDER and KALKOW), A., i, 100.
- Pentane**, physiological action of (ELFSTRAND), A., ii, 423.
- cycloPentane** (*pentamethylene*) derivatives, synthesis of, by means of ethyl adipate (BOUVEAULT), A., i, 171.
 See also **Pentamethylene**.
- Pentanedicarboxylic acids**. See **Dimethylglutaric acids**.
- Pentanehexacarboxylic acid**, ethyl ester (BOTTOMLEY and PERKIN), T., 294; P., 1900, 16.
- Pentanetricarboxylic acid** and its decomposition (BOTTOMLEY and PERKIN), T., 294; P., 1900, 16.
- 2-cycloPentanonecarboxylic acid** (*2-ketopentamethylenecarboxylic acid*) and its derivatives (BOUVEAULT), A., i, 171.
 diethyl ester, bisnitroso- (DIECKMANN), A., i, 297.
- Pentinene** (*isoprene*), constitution of (MOKIEWSKY), A., i, 509.
- Pentosans**, automatic apparatus for the estimation of (STANĚK), A., ii, 373.
- Pentose**, isolation of, from urine (BERGELL and BLUMENTHAL), A., ii, 378.
- Pentoses** (SULEIMAN BEY), A., i, 377.
 estimation of, in urine (SULEIMAN BEY), A., ii, 446.

- Pentylenedicarboxylic acid.** See Dimethylglutaconic acid.
- Pepper, Cayenne,** active principle of (MICKO), A., ii, 58.
- analysis of (GREGOR), A., ii, 775.
- Pepsin,** secretion of, in gastric disease (ROTH), A., ii, 422.
- action of papain on (HARLAY), A., i, 468.
- use of, for estimating the products of digestion (EFFRONT), A., ii, 59.
- Pepsin activity,** quantitative relationships of (SCHÜTZ), A., ii, 666.
- Peptone,** Lilienfeld's so-called (KLIMMER), A., i, 72.
- Peptones,** formation of (BOKORNY), A., i, 126.
- influence of, on urinary secretion (THOMPSON), A., ii, 226.
- Perozone** (*pipitzahoic acid*) as an indicator in alkalimetry (DUYK), A., ii, 308.
- Perfumes,** and the sense of smell (ERDMANN), A., ii, 367.
- behaviour of, in liquid air (ERDMANN), A., ii, 468.
- Perieline** from Salzburg (VIOLA), A., ii, 663.
- Periodic law,** isomorphism in the (BEHRENS), A., ii, 136.
- Periodic system,** representation of the (SCHIRMERSEN), A., ii, 397.
- Peronine.** See Morphine benzyl ether.
- Perowskite** from S. Ambrogio (BOERIS), A., ii, 600.
- Peroxides,** nomenclature of the (v. BAeyer and VILLIGER), A., i, 626.
- metallic, differences in reactions of (TANATAR), A., ii, 211.
- Petit grain,** oil of (JEANCARD and SATIE), A., i, 511.
- Petrocenes** and their derivatives (ZALOZIECKI and GANS), A., i, 593.
- Petroleum,** theory of the origin of (KRAEMER and SPILKER), A., i, 73.
- formation of (KRAEMER and SPILKER), A., i, 73; (ENGLER), A., ii, 216.
- new aromatic hydrocarbon from (KLAUDY and FINK), A., i, 284.
- hydrocarbons with high melting points from (ZALOZIECKI and GANS), A., i, 593.
- Californian, Canadian, Japanese, and Pennsylvanian, composition of (MABERY), A., i, 533.
- Roumanian (SALIGNY), A., ii, 282; (EDELEANU and FILITI), A., ii, 486.
- composition of (PONI), A., i, 617.
- Russian, composition of (WISCHIN), A., i, 146.
- Petroleum,** Texas, composition of (THIELE), A., ii, 147.
- heavy Texas, hydrocarbons in (MABERY and BUCK), A., i, 577.
- estimation of sulphur in (FRIEDLÄNDER), A., ii, 107.
- Petsite** from California (HILLEBRAND), A., ii, 22.
- Phenogams.** See Agricultural Chemistry.
- Phallin,** physiological action of (KOBERT), A., ii, 156.
- Pharmacosiderite** from Cornwall (HARTLEY), A., ii, 23.
- Phase rule.** See Equilibrium.
- Phascolus multiflorus.* See Agricultural Chemistry.
- Phenacetin,** action of sulphuric acid on (COHN), A., i, 29.
- test for, in antipyrine (RAIKOW and SCHARBANOW), A., ii, 456.
- Phenacetyltartaric acid,** diethyl ester, rotation of (MCCRAE and PATTERSON), T., 1096; P., 1900, 161.
- Phenanthraquinone,** *mono-* and *di-*nitro- (KEHRMANN and KIKINE), A., i, 61.
- Phenanthrene,** refraction of (CHILESOTTI), A., i, 339.
- Phenazthionium** chloride, platinum-chloride, and dichromate, 3:5-diamino- (KEHRMANN and SCHILD), A., i, 63.
- Phenazoxonium** bromide, diamino- (KEHRMANN and THOMAS), A., i, 62.
- Phenetidine,** detection of, in urine (EDLEFSEN), A., ii, 378.
- "*p*-Phenetidine, cyano-" and its acetyl and guanidine derivatives (MEVES), A., i, 483.
- p*-Phenetylcaramidesulphonic acid (COHN), A., i, 29.
- Phenoketopentamethyleneazine** (THOMAS-MAMERT and WEIL), A., i, 459.
- Phenol,** dissociation constant of (WALKER and CORMACK), T., 18; P., 1899, 208.
- equilibrium between water, hydrochloric acid and (KRUG and CAMERON), A., ii, 393.
- equilibrium between water, *d*-tartaric or racemic acid and; and water, acetone and (SCHREINEMAKERS), A., ii, 393.
- action of cyanogen bromide on (SCHOLL and NÖRR), A., i, 436.
- condensation of, with ethyl phenylpropionate (RUHEMANN and BEDDOW), T., 984; P., 1900, 123.
- action of phosphoryl chloride on (ODDO), A., i, 92.
- analysis of mixtures of cresols and (DITZ and CEDIVODA), A., ii, 54; (VAUBEL), A., ii, 112.

- Phenol**, estimation of (RIEGLER), A., ii, 112.
- Phenol**, *m*-amino-, condensation of, with ethyl acetosuccinate (V. PECHMANN; V. PECHMANN and SCHALL), A., i, 173; (V. PECHMANN and SCHWARZ), A., i, 174.
- p**-amino-, hydroxyazobenzene and sulphur, compounds from (RIS), A., i, 419.
- tri*-, *tetra*-, and *penta*-bromo- (AUWERS and ANSELMINO), A., i, 160.
- 4:6-dibromo-2-nitro- and 4:6-dibromo-2-amino- (THIELE and EICHWEDE), A., i, 501.
- mono*-, *di*-, and *tri*-chloro-, cyano-, and nitro-derivatives, hydrolysis of (HANTZSCH), A., i, 95.
- o*-nitro-, from nitrobenzene (WOHL), A., i, 157.
- p*-nitro-, as an indicator (SPIEGEL), A., ii, 754.
- 2:4:6-trinitro-. See Picric acid.
- nitroso-, alkaline solutions of, action of benzenediazonium chloride on (BORSCH), A., i, 24, 594.
- thio-. See Phenyl mercaptan.
- Phenol bromide**, tribromo-, constitution of (THIELE and EICHWEDE), A., i, 288.
- Phenol compounds**, new reagent for (CANDUSSIO), A., ii, 513.
- Phenol ethers**, action of cyanogen bromide and aluminium chloride on (SCHOLL and NÖRR), A., i, 386.
- Phenols**, influence of the solvent on the cryoscopic behaviour of (AUWERS, BARTSCH, and SMITH), A., ii, 66.
- action of benzenesulphonic chloride on, in alkaline solution (GEORGESCU), A., i, 343.
- bromination of (DITZ), A., i, 225; (DITZ and CEDIVODA), A., ii, 54; (VAUBEL), A., ii, 112.
- degradation of, during bromination (AUWERS and ANSELMINO), A., i, 159.
- action of, on ethyl acetylenedicarboxylate (RUHEMANN and BEDDOW), T., 1119; P., 1900, 165.
- action of ethylidene chloride on (FOSSE and ETTLINGER), A., i, 392.
- action of, on ethyl phenylpropionate (RUHEMANN and BEDDOW), T., 984, 1119; P., 1900, 123, 165.
- condensation of, with salol and with phenyl *p*-cresotol (COHN), A., i, 548.
- compounds of bismuth with (RICHARD), A., i, 598.
- crystalline compounds of, with succinimide (VAN BREUKELEVEN), A., i, 343.
- Phenols**, sodium derivatives, compounds of, with ethyl esters of α -bromo-fatty acids (BISCHOFF), A., i, 345, 392, 393, 394, 395, 396, 442, 443, 445, 446.
- trisubstituted, action of ethyl nitrite on (THIELE and EICHWEDE), A., i, 501.
- estimation of (RIEGLER), A., ii, 112.
- Phenols**, amino-, action of phenyl cyanate on (FISCHER), A., i, 416.
- bromo-, insoluble in alkalis, formulae of (AUWERS), A., i, 96.
- oxidation products of (AUWERS; AUWERS and EBNER), A., i, 161; (AUWERS, BROICHER, and WOLFF), A., i, 162.
- reduction of (DITZ), A., i, 225; (VAUBEL), A., ii, 112.
- bromo- and chloro-derivatives, action of nitrous and nitric acids on (ZINCKE), A., i, 545.
- Phenols**, list of. See Alcohols and Phenols.
- Phenolasobenzeneazophenol** and its diacetyl derivative (MELDOLA and WILLIAMS), P., 1899, 196.
- Phenolphthalein**, precautions necessary in using, in acidimetric estimations (MAGNIER DE LA SOURCE), A., ii, 620.
- addition of, to marc wines (V. VAMOSSY), A., ii, 676.
- tetrabromo*-, and its oxime (MEYER), A., i, 447.
- Pheno- γ -pyrone**. See Chromone.
- iso*Phenosafranine and its salts (KEHRMANN and KRAMER), A., i, 61.
- Phenothiazine**, 3:5-diamino- and 3:5-dinitro- (KEHRMANN and SCHILD), A., i, 62.
- Phenoxazine**, diamino- (KEHRMANN and THOMAS), A., i, 62.
- Phenoxide**, sodium, condensation of, with the ethyl esters of α -bromo-fatty acids (BISCHOFF), A., i, 345.
- Phenoxides**, nitro-, condensation of, with the esters of α -bromo-fatty acids (BISCHOFF), A., i, 442.
- Phenoxosone**, dinitro-. See *o*-Diphenylene oxide, 3:5-dinitro-.
- Phenoxyacetic acid**, 2:4:6-trichloro- and -tribromo-, and their ethyl esters (BISCHOFF), A., i, 443.
- Phenoxyacetophenone** (VANDEVELDE), A., i, 30.
- α -Phenoxybutyric acids**, and their esters (BISCHOFF), A., i, 345.
- o*-, *m*-, and *p*-nitro-, and their ethyl esters (BISCHOFF), A., i, 442.
- α -Phenoxyisobutyric acid**, 2:4-dichloro-, and its ethyl ester (BISCHOFF), A., i, 443.
- α -Phenoxycinnamic acid**, bromination of (VANDEVELDE), A., i, 30.

- β -Phenoxycinnamic acid** and its ethyl ester (RUHEMANN and BEDDOW), T., 984; P., 1900, 123.
ethyl ester, action of sulphuric acid on (RUHEMANN and STAPLETON), T., 1183; P., 1900, 168.
- Phenoxymaleic acid** and its ethyl ester and amide (RUHEMANN and BEDDOW), T., 1119; P., 1900, 165.
action of sulphuric acid on (RUHEMANN and STAPLETON), T., 1180; P., 1900, 168.
- Phenoxymaleic acid** (RUHEMANN and BEDDOW), T., 1119; P., 1900, 165.
- α -Phenoxy-propionacetal**, and -propaldehyde and its oxime and semicarbazone (STOERMER), A., i, 650.
- α -Phenoxypropionic acid**, 2:4-dichloro-, and *o*-, *m*-, and *p*-nitro-, and their ethyl esters (BISCHOFF), A., i, 442, 443.
- Phenoxypropionic acids**, α - and β -, and nitro- and amino- (BISCHOFF), A., i, 345.
- α -Phenoxypropionyl-*p*-phenetidine** (BISCHOFF), A., i, 345.
- Phenoxystyrene** (RUHEMANN and BEDDOW), T., 984; P., 1900, 123.
- α -Phenoxyisovaleric acid** (BISCHOFF), A., i, 345.
o-, *m*-, and *p*-nitro-, and their ethyl esters (BISCHOFF), A., i, 442.
- Phenetrol** and its ethyl ether and triacetyl derivative (KÖRNER), A., i, 224.
- Phenyl cyanate**, action of, on amino-phenols, and on uramil (FISCHER), A., i, 417.
ethyl carbonate, *o*- and *p*-amino-, *p*-nitro-, and *p*-ureido- (RANSOM), A., i, 220.
- Phenylacethydroxamic acid** and its acetyl derivative (THIRLE and PICKARD), A., i, 30.
- Phenylacetic acid**, β -phenylethyl ester (V. SODEN and ROVAHN), A., i, 489.
p-amino-, reduction of (EINHORN; EINHORN and LADISCH), A., i, 227.
and chloro- and nitro-, action of aldehydes on (V. WALTHER and WETZLICH), A., i, 438.
- ψ -Phenylacetic acid** (BRAREN and BUCHNER), A., i, 292.
- isoPhenylacetic acids**. See *cyclo*Heptatrienecarboxylic acids.
- Phenylacetimino-ethers**, rearrangement of (WHEELER and JOHNSON), A., i, 294.
- Phenylacetonitrile** (*benzyl cyanide*), condensation of, with ethyl cinnamate (ERLENMEYER), A., i, 493.
condensation of, with ethyl fumarate (HENZE), A., i, 347.
- Phenylacetonitrile** (*benzyl cyanide*), and chloro- and nitro-, action of aldehydes on (V. WALTHER and WETZLICH), A., i, 438.
- α -Phenyl-4-acetoxy-3-methoxycinnamic acid**, 2-nitro- and 2-amino- (PSCHORR and SUMULEANU), A., i, 488.
- Phenylacetylchloramine**, discrepancies in the description of its properties, and explanation of the manner it undergoes isomeric change (ARMSTRONG), T., 1047; P., 1900, 160.
See also Phenyl acetyl nitrogen chlorides.
- Phenylacetylene** and its salts, and bromo-, chloro-, and iodo-derivatives (NEF), A., i, 20.
action of hypochlorous and hypobromous acids on (WITTORF), A., i, 421.
- Phenylacetylenaniline**, iodo- (NEF), A., i, 22.
- Phenyl acetyl nitrogen chlorides**, chloro-derivatives of (*acetylchloroaminobenzene*) (CHATTAWAY, ORTON, and HURLEY), T., 800; P., 1900, 125.
- Phenyl acetyl nitrogen chlorides and bromides** (*acetyl-chloro- and -bromoaminobenzene*) and their transformation (CHATTAWAY and ORTON), T., 798; P., 1900, 112.
- β -Phenylacrylic acid**. See Cinnamic acid.
- Phenyl acyl nitrogen bromides** and their bromo-derivatives (CHATTAWAY and ORTON), A., i, 152.
- Phenyl acyl nitrogen chlorides**, *p*-mono- and 2:4:6-*tri*-chloro- (CHATTAWAY and ORTON), T., 134; P., 1899, 232.
- Phenyl acyl nitrogen chlorides and bromides**, and their behaviour to alkalis, potassium cyanide, and zinc ethyl (STIEGLITZ and SLOSSON), P., 1900, 1; discussion, P., 2.
See also Phenylacetylchloramine.
- α -Phenylalanine** and its phenylcarbimide (FISCHER and MOUNEYRAT), A., i, 647.
- Phenylallenecarboxylic acid** (DRBOGLAFF), A., i, 491.
- Phenylamine**. See Aniline.
- Phenylaminopyridothiazine** (HARRIS and KLAMT), A., i, 413.
- Phenylamino-**. See also Anilino-.
- Phenyl-4-mono- and -2:4-di-amino-methylmethane**, 4-amino- (COHN and FISCHER), A., i, 690.
- Phenylisomylaminocetic acid** (EINHORN and PREIFFER), A., i, 221.
- Phenylazo-**. See Benzeneazo-.
- 3-Phenyl-2:4- Δ^2 -benzoxazone**, and its nitro-derivatives (WERNER and HERBERGER), A., i, 57.

- Phenylbenzenylaminooxime** and its nitro-derivatives (WERNER and HERBERGER), A., i, 58.
- Phenylbensiminomethyl ether**, action of heat on (WISLICEN'S and GOLDSCHMIDT), A., i, 435.
- 1-Phenylbensothiazole**, amino-derivatives and their acetyl derivatives (KYM), A., i, 190.
- 1-Phenylbensoxazole-4-carboxylic acid**, methyl ester (EINHORN), A., i, 441.
- 3-Phenyl-4-benzylbenzoxazoline**, 6-nitro- (WERNER and HERBERGER), A., i, 59.
- Phenylbenzyleyanamide** (TRAUBE and v. WEDELSTÄDT), A., i, 389.
- Phenyl benzyl ethers**, substituted (AUWERR, TRAUN, and WELDE), A., i, 168.
- Phenylbenzylhydantoin** (MOUNEYRAT), A., i, 644.
- Phenylbenzylmethylallylammonium salts**, isomeric (WEDEKIND), A., i, 155.
- 1-Phenyl-3-benzoyloxydiazolone** (RUPE and LABHARDT), A., i, 258.
- Phenylbenzylthiosemicarbazide** (CURTIUS), A., i, 611.
- Phenylbromoethylcarbamide** (MENNE), A., i, 286.
- Phenylbromoethylcyanamide** (TRAUBE and v. WEDELSTÄDT), A., i, 390.
- Phenyltert. butylamine** (NEF), A., i, 4.
- Phenylisobutylcarbinol** (GRIGNARD), A., i, 382.
- Phenylisobutylhydantoin** (MOUNEYRAT), A., i, 644.
- α -Phenylisobutyric acid** (WALLACH), A., i, 229.
- Phenylcamphorformeneamine** and its reactions and carboxylic acid (J. B. and A. TINGLE), A., i, 303.
- Phenylcarbamie acid**, carbethoxyamino-phenyl ester (RANSOM), A., i, 219.
- ethyl ester, and its *o*-, *m*-, and *p*-chloro- and *p*-iodo-derivatives (VITTEKAT), A., i, 154.
- Phenylcarbimide** (*phenyl isocyanate*), action of, on dibasic acids (BÉNECH), A., i, 840.
- action of, on ethylacetacetate (DIECKMANN), A., i, 482.
- action of, on ethyl β -aminocrotonate (BEHREND and MEYER), A., i, 287.
- reactions of, with imino ethers (WHEELER and SANDERS), A., i, 563.
- and its *o*-, *m*-, and *p*-chloro- and *p*-iodo-derivatives (VITTEKAT), A., i, 154.
- Phenylcarbylamine**, formation of, by the electrolysis of alkaline alcoholic solutions of nitrobenzene and aniline (MÖLLER), A., i, 27; (HABER and SCHMIDT), A., i, 282.
- Phenyleinnamic acid** and its derivatives and nitriles, preparation of (v. WALTHER and WETZLICH), A., i, 438.
- β -Phenyleinnamic acid**, thio-, and its ethyl ester (RUHEMANN and STAPLETON), T., 1181; P., 1900, 168.
- 3- and 4-Phenylcoumarins** and their derivatives, preparation of (v. WALTHER and WETZLICH), A., i, 438.
- Phenylcyanamide**, reactions of (STIEGLITZ and MCKEE), A., i, 340; (TRAUBE and v. WEDELSTÄDT), A., i, 389.
- Phenyldecahydroacridinediones** (VORLÄNDER and STRAUSS), A., i, 100.
- Phenyl- β -diamyldisulphonopropylthiocarbamide** (POSNER and FAHRENHORST), A., i, 17.
- Phenyl diasopyridothiasinone** (HARRIES and KLAMT), A., i, 413.
- Phenyl- β -diethyl disulphonopropylthiocarbamide** (POSNER and FAHRENHORST), A., i, 16.
- 4-Phenyldihydrodithiasine**, 2:6-dicyano- (HELLSING), A., i, 518.
- 1-Phenyl-2:5-diketotetrahydrothiazole** and its 3-methyl derivative (WHEELER and BARNES), A., i, 565.
- α -Phenyldimethoxyinnamic acids**, 2-nitro- and 2-amino- (PSCHORR and SUMULEANU), A., i, 487; (PSCHORR and BUCKOW), A., i, 489.
- 2-Phenyl-6:6-dimethyl-4-benzoylamine-isobutyl dihydropyrimidine** (TRAUBE and SCHWARZ), A., i, 118.
- Phenyldimethylcarbinol** (GRIGNARD), A., i, 382.
- Phenyldimethyl dihydropyridinedicarboxylic acid**, ethyl ester, action of heat on (GUARESCHI and GRANDE), A., i, 113.
- 1-Phenyl-3:3-dimethyl-indole**, **-2-indolinol**, **-2-indolinone**, and **-3-methyl-eneindoline** (BRUNNER), A., i, 360.
- Phenyldimethylpyrazoleacetic acid**, ethyl ester (MARCH), A., i, 374.
- 1-Phenyldimethylpyrazolone**. See Antipyrine.
- 2-Phenyl-4:5-cis-diphenyl-4:5-dihydroimidazole**. See Amarine.
- 2-Phenyl-4:5-trans-diphenyl-4:5-dihydroimidazole**. See *iso*Amarine.
- Phenyldiphenylene-ethylene**. See Benzylidenefluorene.
- Phenyldipiperonalosotriazone** (MINUNNI), A., i, 260.
- p*-Phenylenebis-2:5-dimethylpyrrole-3:4-dicarboxylic acid**, ethyl ester (BÜLOW), A., i, 690.
- m*-Phenylenediacetyl-dichloro- and -dibromo-amine** (MORGAN), T., 1203; P., 1900, 170.

- m*-Phenylenediamine, acyl derivatives, action of hypochlorous and hypobromous acids on (MORGAN), T., 1203; P., 1900, 170
- 1-*mono*- and 1:5-*di*-chloro- and -bromo-, and their dibenzoyl and diacetyl derivatives (MORGAN), T., 1202; P., 1900, 170.
- 4-chloro-, its acyl derivatives and salts (COHN and FISCHER), A., i, 458.
- nitroso- (TAUBER and WALDER), A., i, 566.
- Phenylenediamines, *m*- and *p*-, hydrochlorides of, colour reaction to distinguish (CUNTIASSE), A., ii, 57.
- o*-Phenylenediamine acetate, action of, on isatin (MARCHELEWSKI), A., i, 100.
- p*-Phenylenediamine 2:6-disulphonic acid (JUNGHAHN and NEUMANN), A., i, 418.
- o*-Phenylenedioxydiacetic acid and ethyl ester, metallic and aniline salts, amide and anilide (CARTER and LAWRENCE), T., 1222; P., 1900, 152.
- m*-Phenylenedioxydiacetic acid and its ethyl ester, metallic and aniline salts, amide, and anilide and 2:4:6-*tri*-nitro-derivative (CARTER and LAWRENCE), T., 1222; P., 1900, 152.
- p*-Phenylenedioxydiacetic acid and its ethyl ester, metallic salts and anilide (CARTER and LAWRENCE), T., 1222; P., 1900, 152.
- Phenylene ditolyl diketone (LIMPRICHT), A., i, 598.
- Phenylerythrosazone, *p*-bromo- (BERTRAND), A., i, 377.
- Phenylethane. See Ethylbenzene.
- 1-Phenyl-4-*o*-ethoxybenzylidene-3-methyl-5-pyrazolone, its *m*- and *p*-ethoxy-, *p*-hydroxy, *p*-methoxy and acetyl compounds (TAMBOUR and ERNST), A., i, 364.
- β -Phenylethyl alcohol. See Benzylcarbinol.
- Phenylethylene. See Styrene.
- N*-Phenylethylene- ψ -carbamide and its salts (MÉNNE), A., i, 286.
- Phenylethylenediazine, reactions of (HISCHMANN), A., i, 251.
- Phenylethylene- ψ -thiocarbamide, its salts and its compound with phenylthiocarbimide (MÉNNE), A., i, 286.
- Phenylethyl-hydantoinic acid and -hydantoin (MOUNEYRAT), A., i, 644.
- 1-Phenyl-3-ethyl-5-ketotriazole-4-carbamide (RUPE and LABHARDT), A., i, 258.
- β -Phenyl- α -ethylpropionic acid, ethyl ester (DIECKMANN), A., i, 624.
- Phenylformiminoethyl ether, action of heat on (WISLICIENUS and GOLDSCHMIDT), A., i, 435.
- Phenylfulvene (THIELE), A., i, 299.
- Phenylfumaric acid, thio-, and its ethyl ester (RUHEMANN and STAPLETON), T., 1183; P., 1900, 168.
- 1-Phenyl-4-furfurylidene-3-methyl-5-pyrazolone (TAMBOUR and LICIŃSKI), A., i, 364.
- 1-Phenyl-3-furfurylpyrazolone (SANDLIN), A., i, 305.
- Phenylglutaconimide, dicyano-. See 6-Hydroxy-4-phenyl- $\Delta^{3,4}$ -dihydropyridone, 3:5-dicyano-.
- Phenylglycine-*o*-carboxylic acid, action of ammonia and aniline on, and acetylation of (VORLÄNDER and WEISSBRENNER), A., i, 295.
- isomeric mono-esters of (VORLÄNDER and v. SCHILLING), A., i, 295.
- Phenylguanidine, *p*-chloroamino- (BUSCH), A., i, 27.
- γ -Phenylhydantoin, preparation of (MOUNEYRAT), A., i, 644.
- Phenylhydrazine, action of, on ethyl β -cyanophenylpyruvate (ERLENMEYER), A., i, 649.
- nitroso-, diazobenzene nitrate from (RÜCHHEIMER), A., i, 532.
- Phenylhydrazines, action of, on thio-cyanoacetic acid (HARRIES and KLAMT), A., i, 413.
- α -acylated, action of, on the chloro-derivatives of quinones (McPHERSON and FISCHER), A., i, 411.
- β -acylated, action of carbamic chloride on (RUPE and LABHARDT), A., i, 258.
- 3-Phenylhydrazino-1-indonephenylhydrazone (SCHLOSSBERG), A., i, 666.
- Phenylhydrazinophenylethylenepicraside (HISCHMANN), A., i, 251.
- Phenylhydrazonocarbodi-*p*-tolylamine, melting point and oxidation product of (SCHALL), A., i, 464.
- Phenylhydrazones of dithiocarbonates (BUSCH and LINGENBRINK), A., i, 66, 411.
- Phenyl-*as*-*o*-hydroxybenzylhydrazine and its *m*-nitrobenzylidene derivative (BAMBERGER and MÜLLER), A., i, 706.
- Phenyl-*o*-hydroxybenzylidenemethylhydrazine (LABHARDT and v. ZEMBRZUSKI), A., i, 125.
- Phenyl-*o*- and -*p*-hydroxybenzyl nitrosoamines (BAMBERGER and MÜLLER), A., i, 705.
- Phenylhydroxyhomocampholic acid (HALLER and MINGUIN), A., i, 452.

- 1-Phenyl-4-*p*-hydroxy-*m*-methoxy-benzylidene-3-methyl-5-pyrazolone and its acetyl and *mp*-dimethoxy compounds (TAMBOR and LICINSKI), A., i, 364.
- C-Phenylhydroxytriazole, and *m*-nitro- and acetyl derivatives (YOUNG and WITHAM), T., 224; P., 1900, 5.
- Phenylalimine (VAUBEL), A., i, 522.
- Phenyliminediphenylacetic acid (HENZE), A., i, 119.
- Phenyliminophenyltetrasolone and its acetyl derivative (BUSCH and BAUER), A., i, 415.
- 3-Phenylimino-2-*p*-tolyl-7-methyl-dihydrophenotriazine and -phenotriazine and its salts (BUSCH and HARTMANN), A., i, 59.
- Phenylindoxyl, attempted synthesis of (HENZE), A., i, 119.
- 2-Phenylketonaphthatriazine and its reactions (BUSCH and HARTMANN), A., i, 60.
- 1-Phenyl-4-ketopyrazoline, and its 3-carboxylic acid, and 5-isonitroso- (WOLFF), A., i, 692.
- 1-Phenyl-4-keto-5-pyrazolone and its 3-carboxylic acid and 5-phenylhydrazone (WOLFF), A., i, 692.
- 1-Phenyl-5-ketotriazole-4-carbamide, and its 3-methyl and 3-ethyl derivatives (RUPE and LABHARDT), A., i, 258.
- Phenyl meconinmethyl ketone and its salts and methyl derivative (FULDA), A., i, 36.
- Phenyl mercaptan (BOURGOIS), A., i, 163.
- condensation of, with ethyl acetylenedicarboxylate and with ethyl phenylpropiolate (RUHEMANN and STAPLETON), T., 1181; P., 1900, 168.
- action of phosphoryl chloride on (AUTENRIETH and RUDOLPH), A., i, 570.
- Phenylmesityliodonium hydroxide and salts (WILLGERODT and ROGGATZ), A., i, 433.
- α -Phenyl-3-methoxycinnamic acid, 2-nitro- and 2-amino- (PSCHORR and JAECKEL), A., i, 488.
- α -Phenyl-*p*-methoxycinnamionitrile, *p*-chloro- (v. WALTHER and WETZLICH), A., i, 438.
- Phenylmethylacetylene (NEF), A., i, 360.
- Phenylmethylacridinium hydroxide and cyanide (HANTZSCH and KALB), A., i, 114.
- Phenylmethylacridol as a pseudo-base (HANTZSCH and KALB), A., i, 114.
- Phenylmethylbutanonioic acid. See β -Benzoyl- α -methylpropionic acid.
- Phenylmethyleyanamide (TRAUBE and v. WEDELSTÄDT), A., i, 389.
- 1-Phenyl-*mp*-methylenedioxybenzylidene-3-methyl-5-pyrazolone (TAMBOR and LICINSKI), A., i, 364.
- α -Phenylmethylenedioxybenzylidene-*p*-chloro- (v. WALTHER and WETZLICH), A., i, 438.
- α s-Phenylmethylethylisocarbamide (STIEGLITZ and MCKER), A., i, 340.
- 1-Phenyl-4-methyl-3-ethyl-5-ketotriazole (RUPE and LABHARDT), A., i, 259.
- Phenylmethylfulvene (THIELE), A., i, 299.
- 5:3-Phenylmethyl- Δ^2 -cyclohexenone (SCHIFF), A., i, 40.
- Phenylmethylhydantoin (MOUNEYRAT), A., i, 644.
- 1-Phenyl-3-methyl-5-ketotriazole-4-carbamide (RUPE and LABHARDT), A., i, 258.
- 2-Phenyl-3-(or 5)-methyl-4-*p*-nitrobenzenes-5-(or 3)-phenylpyrazole, *p*-nitro- (BÜLOW), A., i, 66.
- Phenylmethylnitrosocamine, *mono-p*- and 2:4-*di*-nitro- (BAMBERGER and MÜLLER), A., i, 218.
- Phenylmethyloxazole disulphide (VAILLANT), A., i, 239.
- Phenylmethylpyrazole disulphide (VAILLANT), A., i, 239.
- 1-Phenyl-3-methylpyrazole and its chloro-, bromo-, nitro-, and amino-derivatives, and their salts (MICHAELIS and BEHN), A., i, 693.
- p*-bromo-, and its chloro-, bromo-, nitro-, and amino-derivatives and their salts (MICHAELIS and SCHWABE), A., i, 695.
- 1-Phenyl-5-methylpyrazole (BÜLOW and SCHLESINGER), A., i, 57; (STOLZ), A., i, 252.
- 1-Phenyl-3-methylpyrazole-*Bz-p*-carboxylic acid (3-methylpyrazole-1-*p*-benzoic acid), and its 5-chloro- and 5:4-chlorobromo- (MICHAELIS and SUDENDORF), A., i, 696.
- 1-Phenyl-5-methylpyrazole-3:4-dicarboxylic acid, and its ethyl ester and salts (BÜLOW and SCHLESINGER), A., i, 56; (STOLZ), A., i, 252.
- 1-Phenyl-3-methylpyrazolone, *p*-bromo-, and its 4-anisylidene, 4-benzylidene, and 4-salicylidene derivatives (MICHAELIS and SCHWABE), A., i, 695.
- o*- and *m*-nitro- (MICHAELIS and BEHN), A., i, 693.

- 1-Phenyl-4-methyl-3- and -5-pyrazolones and their acetyl and benzyldene derivatives (FICHTER, ENZENAUER, andUELLENBERG), A., i, 312.
- 1-Phenyl-3-methylpyrazoloneazobenzeneacetoacetic acid, ethyl ester (BÜLOW), A., i, 261.
- 2-Phenyl-4-methylquinoline, *o*-amino-. See *o*-Flavaniline.
- 2-Phenyl-naphthalene, 2'-amino- (GRAEBE and HÖNIGSBERGER), A., i, 506.
- Phenyl-naphthaphenazonium chloride, amino-. See *iso*Rosinduline, No. 8. salts, amino- (KEHRMANN and FILATOFF), A., i, 60.
- 7-Phenyl-naphthaphenazonium salts, 10-nitro- and 10-amino-, behaviour of, to amines (KEHRMANN and VALENCIEN), A., i, 255.
- 12-Phenyl-*iso*naphthaphenazonium 12-bromide and 7-Phenyl-naphthaphenazonium 7-bromide, 2-amino- (*iso*rosindulines 10 and 11) (KEHRMANN and WOLFF), A., i, 463.
- Phenyl-naphthatriasine (FICHTER and SCHIESS), A., i, 366.
- 7-Phenyl-naphthazonium salts, 7-chloro- (FISCHER and HEPP), A., i, 462.
- Phenyl- α -naphthylformarylbenzenes (FICHTER and SCHIESS), A., i, 366.
- Phenyl- α -naphthylodonium hydroxide and salts (WILLGERODT and SCHLÖSSER), A., i, 283.
- 3-(or 5)-Phenyl-4-*p*-nitrobenzeneazo-5-(or 3)-methyl-*isooxazolone*- and -pyrazolone (BÜLOW), A., i, 66.
- Phenyl-*o*-, *m*-, and *p*-nitrobenzylidene-methyl- and -ethyl-hydrazines (LABHARDT and v. ZEMBRZUSKI), A., i, 125.
- α -Phenyl-*o*-, *m*-, and *p*-nitrocinnamonnitriles, *p*-chloro- (v. WALTHER and WETZLICH), A., i, 438.
- iso*Phenyl-nitromethane. See Toluene, ω -isonitro-.
- Phenyl-octahydro-xanthenedione, and *p*-nitro- (VORLÄNDER and STRAUSS), A., i, 100.
- Phenyl-*osazones* and their *p*-bromo-derivatives, purification of and estimation of their rotatory power (NEUBERG), A., i, 139.
- 5-Phenyl-*isooxazolone* (RUHEMANN and STAPLETON), T., 247; P., 1900, 12.
- Phenyl-*para*conic acids, isomeric (FITTING), A., i, 397.
- Phenylphenanthraphenofluorindine and its hydrochloride (KEHRMANN and STOFFEL), A., i, 255.
- 2-Phenylphenol, 4-amino- and 4-nitro- (HILL), A., i, 392.
- 3-Phenylphenotriasine (FICHTER and SCHIESS), A., i, 366.
- Phenyl phthalidomethyl ketone and its salts and methyl derivative (FULDA), A., i, 36.
- Phenylpropionic acid, ethyl ester, action of benzamide, of hydroxylamine, of thiocarbamide and of guanidine on (RUHEMANN and STAPLETON), T., 239; P., 1900, 11.
- condensation of, with guaiacol and with phenyl mercaptan (RUHEMANN and STAPLETON), T., 1181; P., 1900, 168.
- action of phenols on (RUHEMANN and BEDDOW), T., 984, 1119; P., 1900, 123, 165.
- Phenylpropionic acid, *p*-cyano-, and its hydrolysis (MOSES), A., i, 659.
- α -Phenyl-*p*-*isopropyl*cinnamonnitrile, *p*-chloro- (v. WALTHER and WETZLICH), A., i, 438.
- Phenylpropylcyanamide (v. BRAUN), A., i, 431.
- Phenylisopropylcyanamide (v. BRAUN), A., i, 642.
- 3-Phenylpurine, and its salts and chloro- and iodo-derivatives (FISCHER and v. LORREN), A., i, 697.
- Phenylpyridine chloride, dinitro-, (VONGERICHTEN; SPIEGEL), A., i, 51.
- Phenylpyruvic acid, β -cyano-, ethyl ester, action of phenylhydrazine and of hydroxylamine on; and its oxime (ERLENMEYER), A., i, 649.
- 3-Phenylquinoline, *p*-nitro-2-amino- and 2-amino- (PSCHORR and WOLFF), A., i, 170.
- 4-Phenylquinoline derivatives from cinchona alkaloids (KOENTIGS), A., i, 245.
- 2-Phenylquinone (HILL), A., i, 392.
- Phenylrhamnosazone, *p*-nitro- (FEIST), A., i, 569.
- Phenylrosindulines, chloro-derivatives of (FISCHER and HEPP), A., i, 462.
- Phenylstyrene, thio- (RUHEMANN and STAPLETON), T., 1182; P., 1900, 168.
- Phenylsulphon-acetic and -propionic acids, velocity of the reaction of bromine on (RAMBERG), A., ii, 717.
- Phenyltartramic acid, ethyl ester (TINGLE), A., i, 544.
- Phenyltetramethyloctahydro-xanthenedione (VORLÄNDER and STRAUSS), A., i, 100.
- Phenylthiazoline, 2-*p*-bromo-, and its 5-methyl derivative and their salts (SAULMANN), A., i, 687.
- Phenylthiocarbamic acid, alkyl esters (ORNDORFF and RICHMOND), A., i, 156.

- Phenylthiocarbamide**, change in the solubility of, by the addition of salts (ROTHMUND), A., ii, 487.
- Phenylthiocarbasinic acid**, esters, formation of (BUSCH and LINGENBRINK), A., i, 413.
- esters and salts of, acid hydrolysis of (BUSCH and LINGENBRINK), A., i, 66, 411.
- Phenylthiocarbimide** (*phenyl isothiocyanale*) as a reagent for the detection of the alcoholic hydroxyl group (ORNDORFF and RICHMOND), A., i, 156.
- action of, on dibasic acids (BÉNECH), A., i, 340.
- action of, on *o*-aminoazotoluene (BUSCH and HARTMANN), A., i, 59.
- action of, on carpine and cytosine (LITTERSCHER), A., i, 516.
- reactions of, with imino ethers (WHEELER and SANDERS), A., i, 563.
- Phenylthiocarbasinic acid**, esters of, molecular rearrangement of, and their benzoyl derivatives (WHEELER and BARNES), A., i, 564.
- Phenylthionine** and its salts (SCHAFSCHNIKOFF), A., i, 524.
- Phenylthiosulphonacetosacetic acid**, ethyl ester (TROGER and EWEES), A., i, 495.
- Phenyl-*p*-tolenylaminooxime**, dinitro- (WERNER and HERBERGER), A., i, 58.
- Phenyl-*p*-tolylidonium** hydroxide, iodide, and bromocamphorsulphonate (KIPPING and PETERS), P., 1900, 62.
- Phenyltolylmethane**, *p*-cyano-, and **Phenyltolylmethane-*p*-carboxylic acid** (MOSES), A., i, 659.
- Phenyl-*p*-tolylthiocarbamide**, and the action of chloroacetone on (v. WALTHER and STENZ), A., i, 569.
- 1-Phenyl-4:6-trimethylidihydropyrimidine**, 2-amino- (TRAUBE and SCHALL), A., i, 118.
- 2-Phenyl-4:6-trimethylidihydropyrimidine** (TRAUBE and SCHWARZ), A., i, 117.
- 3-Phenyl-1:4:6-trimethyluric acid** (FISCHER), A., i, 417.
- β -Phenyluraminocrotonic acid**, ethyl ester, and its isomeride (BEHREND and MEYER), A., i, 287.
- Phenyluracine** and its triacetyl derivative, and compound with benzaldehyde, and its conversion into phenylurazole (BUSCH and HEINRICH), A., i, 314.
- Phenylurethane** from phenol and mercuric fulminate (SCHOLL and KACER), A., i, 218.
- Phenyluric acids** and the action of methyl iodide on (FISCHER), A., i, 417.
- Phenylxylylethane**, distillation of, under pressure (KRAMER and SPILKER), A., i, 617.
- Phloretic acid**, identity of, with hydro-*p*-coumaric acid (BOUGAULT), A., i, 495.
- Phloridin**, action of, on muscle (LEE and HARROLD), A., ii, 558.
- Phloridin diabetes**, influence of, on lactation (LUSK), A., ii, 558.
- Phloroglucinol** from the fusion with alkali of colouring matters from tannins (PERKIN), T., 424; P., 1900, 45.
- purification of (FRAPS), A., i, 645.
- ethyl ether (HERZIG and AIGNER), A., i, 545.
- methyl ether and its diacetyl, dibenzoyl, and tribromo-derivatives (HERZIG and AIGNER), A., i, 545.
- nitroso-derivatives of (WEIDEL and POLLAK), A., i, 290.
- dimethyl ether, action of a nitrite and acetic acid on (WEIDEL and POLLAK), A., i, 290.
- Phloroglucinols**, homologous, condensation of, with salicylaldehyde (WEIDEL and WENZEL), A., i, 308.
- bromo-derivatives (HERZIG, POLLAK, and ROHM), A., i, 595.
- Phloroglucinolcarboxylic acid**, methyl and ethyl esters (HERZIG and WENZEL), A., i, 176.
- Phorone**, action of amidines on (TRAUBE and LORENZ), A., i, 116.
- Phosphates**. See under Phosphorus and Agricultural Chemistry.
- Phosphatic deposits in Japan** (TRUNETO), A., ii, 43.
- Phosphine**. See Hydrogen phosphide.
- Phosphometer** (JOLLES), A., ii, 311.
- Phosphor-copper**, analysis of (BORN-TRÄGER), A., ii, 689.
- Phosphorescence** produced by radium radiations (BEQUEREL), A., ii, 126.
- of inorganic substances (GOLDSTEIN), A., ii, 702.
- of phosphoric oxide (EBERT and HOFFMANN), A., ii, 517.
- Phosphoric esters** (CAVALIER), A., i, 75; (CAVALIER and PROST), A., i, 579.
- Phosphorite** from N. Germany (KORRT), A., ii, 734.
- Phosphorites** from Sweden (ANDERSSON and SAHLBOM), A., ii, 148.
- Phosphorechaleite** (*chile*) from near Wiesbaden (PETERSEN), A., ii, 662.

Phosphorus, preparation of, free from arsenic (NÖLTING and FEUERSTEIN), A., ii, 722.

supposed transformation of, into arsenic and antimony (WINKLER), A., ii, 476; (FITTICA), A., ii, 651; (NÖLTING and FEUERSTEIN), A., ii, 722.

in muscle (MACLEOD), A., ii, 92.

in paranuclein from casein (JACKSON), A., ii, 606.

metabolism of (NOËL-PATON, DUNLOP, and AITCHISON), A., ii, 222; (LEIPZIGER), A., ii, 223.

Phosphorus pentabromide, supposed allotropism of (KASTLER and BEATTY), A., ii, 538.

Phosphoryl bromide, molecular weight of, in various solvents (ODDO and SERRA), A., ii, 75.

Phosphorus pentachloride, molecular weight of (ODDO and SERRA), A., ii, 74.

action of water and of phosphoric oxide on (ODDO), A., i, 92.

Phosphoryl chloride, molecular weight of, in various solvents (ODDO and SERRA), A., ii, 75.

action of, on aromatic amines and on phenyl mercaptan, in presence of alkali (AUTENRIETH and RUDOLPH), A., i, 570.

action of water, of potassium chlorate, of aniline, and of phenol on (ODDO), A., i, 92.

Thiophosphoryl chloride, molecular weight of, in various solvents (ODDO and SERRA), A., ii, 75.

Pyrophosphoryl chloride, preparation of (ODDO), A., i, 92.

Phosphorus, lower oxides of (MICHAELIS and PITSCH), A., ii, 137; (BESSON), A., ii, 539.

Phosphoric oxide, phosphorescence of (EBERT and HOFFMANN), A., ii, 517.

new compounds of, with benzene (GIRAN), A., i, 146.

Phosphoric acid, behaviour of, in presence of saturated solutions of calcium hydrogen carbonate (SCHLÖSING), A., ii, 541, 618.

double compounds of aromatic aldehydes and esters with (RAIKOW), A., i, 602.

estimation of, by molybdate (HANAMANN), A., ii, 311.

estimation of, as phosphomolybdic oxide (SHERMAN and HYDE), A., ii, 757.

estimation of, in basic slags (HERZFELD), A., ii, 243, 367.

Phosphorus :—

Phosphoric acid, soluble, Wagner's reagent for the estimation of, in basic slag (CASALI), A., ii, 311.

available, estimation of, in soil (PAGNOUL), A., ii, 167.

estimation of, in soil, by the humic acid method (HOFFMEISTER), A., ii, 244.

available as plant food, estimation of, in soils and manures (PIOT), A., ii, 510.

available, estimation of, in manure (VEITCH), A., ii, 166.

See also Agricultural Chemistry.

Phosphate solutions, metallic, electrolysis of (FERNBERGER and SMITH), A., ii, 109.

Phosphates, natural, estimation of alumina and ferric oxide in (VEITCH), A., ii, 577.

See also Agricultural Chemistry.

Metaphosphoric acid, identity of, with plasmic acid (ASCOLI), A., i, 128.

Metaphosphates (v. KNORRE), A., ii, 651.

Superphosphate, bone, detection of adulterations of (LASNE), A., ii, 167, 311.

Phosphorous acid, a general property of (VANINO), A., ii, 138.

Phosphotungstic acid as a test for potassium (WÖKNER), A., ii, 370.

Phosphorus trisulphide, preparation of (SPRINGER), A., ii, 399.

Phosphorus, detection and estimation of :—

detection of free (MUKERJI), A., ii, 756.

apparatus for the estimation of (SHIMER), A., ii, 50.

estimation of, by Reed's method (GERHARDT), A., ii, 108.

apparatus for the clinical estimation of, in blood (JOLLEN), A., ii, 311.

estimation of, in coal and coke (CAMP), A., ii, 756.

estimation of, in organic compounds (MARIE), A., ii, 108.

estimation of, in ores, pig-iron, and steel containing arsenic (CAMP), A., ii, 757.

estimation of, in steel, etc. (IBBOTSON and BREAKLEY), A., ii, 757.

Phosphoryl-anilide, -*p*-phenetide, and -*p*-toluidide, thio- (AUTENRIETH and RUDOLPH), A., i, 570.

Phosphoryl-brometoluidide, -*p*-chloro-anilide, and -*p*-phenetide and its nitro-derivative (AUTENRIETH and RUDOLPH), A., i, 570.

Phosphoxyanilides (ODDO), A., i, 92.

PHOTOCHEMISTRY:—

Light, chemical action of, compared with the chemical effects of the silent electric discharge (BERTHELOT), A., ii, 329.

influence of, on the electrical properties of metals (BUISSON), A., ii, 519.

oxidation and hydration of organic compounds under the influence of (BERTHELOT), A., i, 3.

sensitiveness of lead and silver to (WATERHOUSE), A., ii, 585.

influence of, on the action of chlorine on metallic silver (v. CORDIER), A., ii, 343, 723.

action of, on nitrogen iodide (CHATTAWAY and ORTON), A., ii, 594.

influence of, on the hydrolysis of platonic chloride (KOHLEBAUSCH), A., ii, 408.

influence of, on the transformation of styrene to metastyrene (LEMOINE), A., i, 91.

Photochemical effects produced by the Hertzian radiating wire (TOMMASINA), A., ii, 519.

experiments on silver chloride and bromide (LUTHER), A., ii, 181.

Photographic action of minerals containing thorium and uranium (AFANASSIEFF), A., ii, 702.

developers, brazilin and hæmatoxylin as (LEPETIT), A., ii, 519.

Latent image, theory of the (LUTHER; ABEGG), A., ii, 253; (ENGLISH), A., ii, 381.

Radiations from radium (BECQUEREL; VILLARD), A., ii, 381.

phosphorescence produced by (BECQUEREL), A., ii, 126.

effect of the magnetic field on (CURIE), A., ii, 126; (BECQUEREL), A., ii, 182, 183.

from thorium and uranium compounds (CURIE), A., ii, 81; (P. and S. CURIE; P. and S. CURIE and BÉMONT), A., ii, 82.

from uranium (BECQUEREL), A., ii, 518.

Radio-active substances (GIESEL), A., ii, 480.

new, from pitchblende (DEBIERNE), A., ii, 20, 350; (CURIE), A., ii, 81; (P. and S. CURIE; P. and S. CURIE and BÉMONT), A., ii, 82.

from thorium and its compounds (RUTHERFORD), A., ii, 351, 352.

from uranium ores (GIESEL), A., ii, 19.

from uranium residues, atomic weight of (CURIE), A., ii, 83.

PHOTOCHEMISTRY:—

Radio-active substances, spectrum of (DEMARÇAY), A., ii, 83.

radiation of (BECQUEREL), A., ii, 126.

rays from, influence of the magnetic field on (BECQUEREL), A., ii, 126.

See also Polonium and Radium.

Radio-active barium (v. LENGYEL), A., ii, 402; (GIESEL), A., ii, 480;

(DEBIERNE), A., ii, 586.

atomic weight of (CURIE), A., ii, 83, 654.

Radio-activity of uranium (CROOKES), A., ii, 586.

produced in substances by the action of thorium compounds (RUTHERFORD), A., ii, 352.

Becquerel rays, chemical action of (P. and S. CURIE), A., ii, 125.

action of the magnetic field on (CURIE), A., ii, 126.

and Röntgen rays, fluorescence of metallic compounds under the influence of (BARY), A., ii, 330.

Cathode rays, electrical conductivity in gases traversed by (MCLENNAN), A., ii, 587.

Röntgen rays, chemical action of, on glass (VILLARD), A., ii, 125.

absorption of, by aqueous solutions of metallic salts (BLYTHSWOOD and MARCHANT), A., ii, 182.

velocity of the ions produced in gases by (ZELENY), A., ii, 787.

Polarisation:—

Rotation, conditions determining the stability of (LE BEL), A., ii, 462.

of *d*- and *l*-isomarine and their acid tartrates (SNAPK) T., 784; P., 1900, 118.

of benzylidenecamphor (MINGUIN), A., i, 301.

of bornylamine salts, bornyloxamide, dibornyloxamide, and neobornylamine (FORSTER and HARTSMITH), T., 1152; P., 1900, 166.

of aromatic compounds of camphor (HALLER and MÜLLER), A., i, 182.

of alcoholic solutions of camphor, influence of the amount of water on (PARTHEIL and VAN HAAREN), A., i, 507.

of camphoroximeacetic acid and its salts (FORSTER and HARTSMITH), T., 1154; P., 1900, 166.

of *d*-erythrose and *d*-erythronic acid (RUFF and MEUSSER), A., i, 139.

of hydrindamine bromo- and chloro-camphorsulphonates and *cis*- π -camphanates (KIPPING), T., 884; P., 1900, 51.

PHOTOCHEMISTRY :—

- Rotation** of malic acid in the pure state and in solution (WALDEN), A., i, 11.
- of complex salts of malic and tartaric acids (ROSENHEIM and ITZIG), A., i, 185, 272.
- of methylethylphenacylsulphine *d*-bromocamphorsulphonates and pierates (SMILES), T., 1177; P., 1900, 168.
- of *d*-methylethylthetine platini-chloride, *d*-camphorsulphonate, and *d*-bromocamphorsulphonate (POPE and PEACHEY), T., 1072; P., 1900, 12.
- of ψ -nitrocamphane (FORSTER), T., 258; P., 1900, 13.
- of phenylosazones (NEUBERG), A., i, 139.
- of pilocarpine, isopilocarpine and pilocarpidine and their salts (JOWETT), T., 480.
- of acetyl and phenacetyl derivatives of diethyl *d*-tartrate (McCRAE and PATTERSON), T., 1096; P., 1900, 161.
- of sorbinose (SMITH and TOLLENS), A., i, 378.
- of starch (RODEWALD and KATTEIN), A., i, 477.
- of solutions of sucrose, influence of pressure on the (SIERTSEMA), A., ii, 329.
- variation of, with the temperature (SCHÖNROCK), A., i, 378.
- of active valeric acid (GUYE and ASTON), A., ii, 253.
- Magnetic rotation** in solutions of acids and salts, effect of concentration on (FORCHHEIMER), A., ii, 524.
- of the benzenoid hydrocarbons (PERKIN), T., 267; P., 1899, 237.
- of hexamethylene and *mono*- and *di*-chlorohexamethylene (PERKIN), T., 372; P., 1900, 44.
- Refraction** of metals (VAN AUBEL), A., ii, 125.
- of potassium chloride solutions (BENDER), A., ii, 461.
- of sodium tungstate solutions (PAWLEWSKI), A., ii, 400.
- of mixtures (PERKIN), T., 280; P., 1899, 237.
- of tautomeric substances (BRÜHL), A., i, 497.
- of aromatic compounds of camphor (HALLER and MÜLLER), A., i, 182.
- of ethyl ether near the critical point (GALITZIN and WILIP), A., ii, 461.

PHOTOCHEMISTRY :—

- Refraction** of hydrocarbons with condensed benzene nuclei (CHILESOTTI), A., i, 389.
- of the benzenoid hydrocarbons (PERKIN), T., 267; P., 1899, 237.
- of hexamethylene and *mono*- and *di*-chlorohexamethylene (PERKIN), T., 372; P., 1900, 44.
- Dispersion** of tautomeric substances (BRÜHL), A., i, 497.
- of aromatic compounds of camphor (HALLER and MÜLLER), A., i, 182.
- Spectrographic method**, value of, in tautomerism (HARTLEY and DOBBIE), T., 498; P., 1900, 57.
- of determining the constitution of nitrogen compounds (BRÜHL), A., i, 210.
- Spectra** of stars, origin of certain unknown lines in the (LUNT), A., ii, 585.
- of liquids in the ultra-red (PUCCIANTI), A., ii, 585.
- of gases, influence of slight impurities on (LEWIS), A., ii, 1, 701.
- of ammonia, methylamine, hydroxylamine, acetaldoxime and acetoxime (HARTLEY and DOBBIE), T., 318; P., 1900, 14.
- of argon, new lines in the (NASHNI, ANDERLINI, and SALVADORI), A., ii, 181.
- of bromine (EDER and VALENTA), A., ii, 330.
- of chlorine (EDER and VALENTA), A., ii, 72.
- of hydrogen and of water vapour (TROWBRIDGE), A., ii, 701.
- luminescence, of the rare earths (MUTHMANN and BAUR), A., ii, 544.
- new, of the rare earths (DEMARÇAY), A., ii, 656.
- of solutions of didymium and erbium salts, effects of dilution, temperature, etc., on (LIVING), A., ii, 517.
- of gadolinium magnesium nitrate (DEMARÇAY), A., ii, 597.
- of neodymium and praseodymium (MUTHMANN and STÜTZEL), A., ii, 18.
- of samarium (DEMARÇAY), A., ii, 404.
- of a radio-active substance (DEMARÇAY), A., ii, 83.
- of radium (DEMARÇAY), A., ii, 83, 586; (RUNGE), A., ii, 641.
- of silicon (LOCKYER), A., ii, 181.
- of vanadium (HASSELBERG), A., ii, 381.

PHOTOCHEMISTRY:—

- Spectra of benz-anti- and -syn-aldoximes** (HARTLEY and DOBBIE), T., 509; P., 1900, 58.
- of 2:5-dimethylpyrazine (HARTLEY and DOBBIE), T., 846; P., 1900, 129.
- of ethyl dibenzoylsuccinates (HARTLEY and DOBBIE), T., 498; P., 1900, 57.
- of hexamethylene and tetrahydrobenzene (HARTLEY and DOBBIE), T., 846; P., 1900, 129.
- of methylfurfuraldehyde and of vegetable products (WIDTSE and TOLLENS), A., i, 244.
- of *o*-oxycarbanil and its ethers (HARTLEY, DOBBIE, and PALATSEAS), T., 889; P., 1900, 130.
- of chlorophyll and its colouring matters (MARCHLEWSKI and SCHUNCK), T., 1080; P., 1900, 148.
- of the colouring matters of leaves (SCHUNCK), A., ii, 37.
- of hematorporphyrin (ARNOLD), A., i, 127.
- of bromohematorporphyrin and bromophylloporphyrin (MARCHLEWSKI and SCHUNCK), T., 1093.
- lamps for (BECKMANN), A., ii, 701.
- Spectrometer scale reader**, improved (PERKIN), T., 291.
- Photography**. See under Photochemistry.
- Photomethemoglobin**. See under Hemoglobin.
- Phototropy** (MARCKWALD), A., ii, 2; (BILTZ), A., ii, 125.
- See also Colour.
- Phrenosin**. See Cerebrin.
- Phthalaldehyde** and its tetracetate and dioxime and *iso*Phthalaldehyde tetracetate (THIELE and WINTER), A., i, 501.
- o*-Phthalaldehydic acid, compound of, with *o*-hydroxydiphenylacetic hydrazide (WEDEL), A., i, 363.
- Phthalanil**, 3:6-dichloro- (GRAEBE and GOUREVITZ), A., i, 547.
- Phthalic acid**, dichloro-, commercial, purification of (GRAEBE), A., i, 546.
- 3:6-dichloro- and its esters (GRAEBE), A., i, 546, 547; (GRAEBE and GOUREVITZ), A., i, 547.
- iso*Phthalic acid, diamino-, quinoneimide of (NIETZKI and PETRI), A., i, 486.
- tetramino-, formation of (NIETZKI and PETRI), A., i, 487.
- p*-Phthalic acid. See Terephthalic acid.
- Phthalide-di- and -tri-carboxylic acids**, synthesis of (DOEBNER), A., i, 499.

- Phthalidedimethyl ketone** and its salts and methyl derivative (FULDA), A., i, 36.
- Phthalimide**, bromo- and chloro-, conversion of, into acetylthranil and isatoic anhydride (BREIT and HOF), A., i, 229.
- 3:6-dichloro- (GRAEBE and GOUREVITZ), A., i, 547.
- Phthalonic acid** and its imide and **Phthalonamic acid** (GABRIEL and COLMAN), A., i, 360.
- Phthaloylphthalic acid**, anhydride and imide (LIMPRICHT), A., i, 600.
- Phthaloyltoluoylbenzoic acid** (LIMPRICHT), A., i, 600.
- Phthalylaminoacetic acid**, ethyl ester, action of sodium alkyl oxides on (GABRIEL and COLMAN), A., i, 358.
- Phthalyliminoacetone-amymercaptols**, diamyldisulphone, -benzylmercaptols, -dibenzylidysulphone, -phenylmercaptols, and -diphenyldisulphones (POSNER and FAHRENHORST), A., i, 17.
- Phthalyliminoketones**, transformations of (GABRIEL and COLMAN), A., i, 689.
- o*-Phthalylimino-propionic and -butyric acids, ethyl esters, action of sodium alkyl oxides on (GABRIEL and COLMAN), A., i, 358.
- Phyllades** from the Ardennes (READE and HOLLAND), A., ii, 150.
- Phylloporphyrin**, action of bromine on (MARCHLEWSKI and SCHUNCK), T., 1091; P., 1900, 149.
- Phyllorubin** (MARCHLEWSKI), A., i, 404.
- Phylloxanthin** (BODE), A., i, 109.
- Physical properties** and atomic weights (SANDER), A., ii, 137; (BAYLEY), A., ii, 188.
- Physical reactions**, and the mass law (LINCOLN), A., ii, 392.
- Physico-chemical reaction**, the driving tendency of, and its temperature coefficient (RICHARDS), A., ii, 533.
- Physiological action** and chemical constitution, relation between (PADERT), A., ii, 742.
- of acetonechloroform (*chlorotone*) (ALDRICH and HOUGHTON), A., ii, 358.
- of acetonedicarboxylic and citric acids (SABBATANI), A., ii, 32.
- of alkaloids of the Boraginæ (GREIMMER), A., i, 684.
- of alkylated alkaloids in relation to their chemical constitution (ROSENSTEIN), A., ii, 294.
- of anagryne and cytosine (SCHMIDT), A., i, 513.
- of antipyrine (LAWROFF), A., ii, 741.

Physiological action of Wakamba arrow poison (BRIEGER), A., i, 243.
 of bromine (FESSEL), A., ii, 227.
 of caffeine (KRÜGER), A., ii, 30, 93; (KATSUYAMA, KUWAHARA, and SENO), A., ii, 94; (BOCK), A., ii, 424.
 of carbohydrates (ROSENFELD), A., ii, 358; (CHARRIN and GUILLÉMONAT), A., ii, 606; (MÜNCH), A., ii, 607.
 of cheiranthin and cheirinine (REEB), A., i, 186.
 of chrysarobin and its oxidation product (MARFORI), A., i, 554.
 of creatine and creatinine (MALLET), A., ii, 156.
 of 3-cyano-1:2:3:4-tetramethylpyridone (SABBATANI), A., ii, 94.
 of drugs (FRÄNKEL), A., ii, 423.
 of formaldehyde (BRUNI), A., ii, 359.
 of extracts of sympathetic ganglia (CLEGHORN), A., ii, 557.
 of the poison of the Gila monster (VAN DEUBURG and WIGHT), A., ii, 677.
 of glucosamine hydrochloride (OFFER and FRÄNKEL), A., ii, 294.
 of 8-hydroxyquinoline (ROST), A., ii, 154.
 of *o*-hydroxyquinolinesulphonic acid (BRAHM), A., ii, 95.
 of iodine, sodium iodide and iodothyryl (BARBERA), A., ii, 291.
 of japaconitine (DUNSTAN and READ), T., 53.
 of menthol and menthyl acetoacetate (COHN and TAUSCH), A., i, 350.
 of *p*-mercuriodiphenylenetetraethylmercuridiummonium acetate (BENEDICENTI and POLLEDRO), A., ii, 359.
 of methylnitroamine, in relation to its constitution (SPRUYT), A., i, 142.
 of 1- and 4-methylxanthines (ALBANESE), A., ii, 424.
 of 4-methylxanthine (KRÜGER and SCHMIDT), A., ii, 31.
 of morphine (WINTERNITZ), A., ii, 221, 489; (IMPENS), A., ii, 228.
 of mucin (LEVIN), A., ii, 295, 555.
 of extracts of nervous tissues (HALLIBURTON; OSBORNE and VINCENT), A., ii, 423.
 of nicotine (WINTERBERG), A., ii, 424.
 of nitriles (FIQUET), A., ii, 424.
 of paraxanthine (KRÜGER and SCHMIDT), A., ii, 31.
 of pentane, cyclopentadiene, and valeraldehyde (ELFSTRAND), A., ii, 423.
 of phallin (KOBERT), A., ii, 156.
 of phloridzin (LEE and HARROLD; LUSK), A., ii, 558.
 of pilocarpine, isopilocarpine, and pilocarpidine (JOWETT), T., 497.

Physiological action of piperidinealkines (PADERI), A., ii, 742.
 of poisons (GUILLERY), A., ii, 95; (GIES and ASHER), A., ii, 291; (FRÄNKEL), A., ii, 423; (LINDEMANN), A., ii, 492; (WEDENSKI), A., ii, 739.
 of potassium chlorate (MELTZER), A., ii, 296.
 of protamines and their decomposition products (THOMPSON), A., ii, 227.
 of samandarine and of samandaridine sulphates (FAUST), A., i, 186.
 of soaps (MUNK), A., ii, 418.
 of Poehl's spermine (DIXON), A., ii, 676.
 of sugars (HÉDON and ARROUS), A., ii, 94.
 of tellurium compounds (GIES and MEAD), A., ii, 294.
 of theobromine (KRÜGER and SCHMIDT), A., ii, 31; (BOOK), A., ii, 424.
 of veratrine and protoveratrine (WALLER), A., ii, 425.
Physiology of the suprarenal capsules (BORUTTAU), A., ii, 225; (MOORE and PURINTON), A., ii, 492.
Phytosterol, retention of, in the organism, after feeding with cotton-seed oil (VIRCHOW), A., ii, 93.
 detection of, in fats (KREIS and RUDIN), A., ii, 252.
Picene, synthesis of (HIEN), A., i, 151.
Picotite from Steinegg, Austria (MRHA), A., ii, 218.
Pieramic acid, dicyano-(4:6-dinitro-2-amino-3:5-dicyanophenol). See *isopurpuric acid*.
Picric acid (2:4:6-trinitrophenol), and its solutions, colour of (MARCKWALD), A., i, 391.
 oxidation of, in presence of ferrous salts (FENTON and JONES), T., 76; P., 1899, 224.
Pieryl acetate, action of diazomethane on (v. PECHMANN), A., i, 313.
Pieryl chloride, improved method of preparing (JACKSON and GAZZOLO), A., i, 484.
 action of, on aromatic amines (WEDEKIND), A., i, 216.
 action of, on catechol (HILLYER), A., i, 289.
Pieryl- α - and - β -naphthylamines (BAMBERGER and MÜLLER), A., i, 217.
Pigment, green, of *Amanita muscaria* (GRIFFITHS), A., ii, 235.
 of the Arenicolæ (FAUVEL), A., ii, 227.
 blue, of coral (LIVERSIDGE), A., i, 70.

Figs. See Agricultural Chemistry.

Pilocarpidine, constitution, properties and salts of (JOWETT), T., 473; P., 1900, 50.

Pilocarpine and *isopilocarpine*, constitution, properties, reactions, salts and physiological action of (JOWETT), T., 473; P., 1900, 49.

Pilocarpine, constitution of (JOWETT), T., 494, 851; P., 1900, 50, 123; A., i, 686.

oxidation of, with permanganate (PINNER and KOHLHAMMER), A., i, 456, 685.

bromide derivatives, and oxidation of (PINNER and KOHLHAMMER), A., i, 456.

isopilocarpine, oxidation of, with permanganate, and reactions of, with soda lime, fused caustic potash, and methyl iodide (JOWETT), T., 851; P., 1900, 123.

Pilocarpoic acid, $C_{11}H_{16}O_8N_2$ (PINNER and KOHLHAMMER), A., i, 686.

Piluvic acid, $C_8H_{14}O_6$, and its salts (JOWETT), T., 855; A., i, 856; (PINNER and KOHLHAMMER), A., i, 685.

Pinacolin and its dioxime, and α -di-bromo- and α -dichloro- (WITTORF), A., i, 422.

Pinacone formate (BEHAL), A., i, 581.

Pinene, ψ - and σ -, formulæ of (SEMMLER), A., i, 453.

oxidation of (WALLACH and SCHÄFER), A., i, 241.

hydrochloride and hydriodide, relation of, to bornyl chloride and iodide (WAGNER and BRICKNER), A., i, 46.

Pinenol and its acetyl derivative (GENVRESSE), A., i, 351.

Pinenone and its oxime and acyl derivatives (GENVRESSE), A., i, 351.

i-**Pinocampholenic acid**, **Pinodihydrocampholenolactone**, *i*-**Pinonic** and *i*- and *l*-**Pinolic acids** (TIEMANN), A., i, 625.

Pinus Abies, cymene from (KLASON), A., i, 676.

Piperasine. See Diethylenediamine.

Piperidine (*hexahydropyridine*), action of, on α -benzoylamino cinnamic anhydride (ERLENMEYER), A., i, 550.

action of bromoacetophenone on (SCHMIDT and HARTONG VAN ARK), A., i, 686.

action of diazotised amino-compounds on (WALLACH and TEWES), A., i, 264.

action of iodine on (SCHMIDT), A., i, 187.

Piperidine (*hexahydropyridine*) derivatives, synthesis of (GUARESCHI and GRANDE), A., i, 111; (MINOZZI), A., i, 407.

synthesis of, in the organism (HILDEBRANDT), A., ii, 676.

abnormal aurichloride of (FENNER and TAFEL), A., i, 111.

Piperidinealkines. See Hydroxyethylpiperidines.

Piperidyl-mono- and -di-acetophenone and its salts (SCHMIDT and HARTONG VAN ARK), A., i, 686.

Piperonylacetone, nitro-, and its semicarbazone (ANGELI), A., i, 553.

Piperonylidene-d- and -l-camphor (HALLER), A., i, 301.

Piperylene nitrogen chloride (WILLSTÄTTER and IGLAUER), A., i, 458.

Pipitsaholic acid. See Perezone.

Pitchblende, radio-active substances from (DEBIERNE), A., ii, 20, 350; (CURIE), A., ii, 81; (P. and S. CURIE; P. and S. CURIE and BÉMONT), A., ii, 82.

Placenta and its ash, composition of the (GRANDIS), A., ii, 608, 609.

Plagioclase, composition of (TARASENKO), A., ii, 354.

Plagioliparites of Cape Marsa (DUPARC and PEARCE), A., ii, 220.

Plane tree. See Agricultural Chemistry.

Plankton from Kiel Bay, composition of (BRANDT), A., ii, 609.

Plants, estimation of cell-wall constituents, hemicelluloses, and cellulose in (KLEIBER), A., ii, 630.

See also Agricultural Chemistry.

Plasmic acid, identity of, with metaphosphoric acid (ASCOLI), A., i, 128.

Plasmolysis (VANDEVELDE), A., ii, 302.

Plasmon (PODA and PRAUSNITZ), A., ii, 289.

Platinum, influence of finely divided, on the combination of hydrogen and oxygen (FRENCH), A., ii, 718.

colloidal, as an inorganic ferment, and action of, on hydrogen peroxide (BREDIG and MÜLLER v. BERNECK), A., ii, 213.

commercial, cause of the loss of weight of, when heated under some conditions (HALL), A., ii, 659.

Platinum alloys with cadmium, magnesium and with zinc (HODGKINSON, WABING, and DESBOROUGH), A., ii, 282.

with gold, analysis of (PŁIWOZNIK), A., ii, 111.

Platinum compounds of hydroxylamine (UHLENHUTH), A., ii, 485, 659.

- Platinum tetrachloride** and its double salts (MIOLATI), A., ii, 214.
 hydrolysis of, on standing, and under the influence of light (KOHLEAUSCH), A., ii, 408.
- Tetrabromoplatinic acid** and **Penta-chloroplatinic acid** and their salts (MIOLATI and BELLUCCI), A., ii, 732.
- Platinum organic compounds** :—
Platinum bases, constitution of (JÖRGENSEN), A., i, 542; (BIILMANN), A., i, 543.
- Platodiammineplatosemi-ethylene** and -**ammine chlorides** (JÖRGENSEN), A., i, 542.
- Platosemiallyalcohol chloride**, compounds of, with potassium and with platodiamminechloride (BIILMANN), A., i, 543.
- Platosemi-ammine** and -**ethylene**, compounds of, with aminonium, potassium and silver chlorides (JÖRGENSEN), A., i, 542.
- Platinum, estimation of** :—
 estimation of small quantities of, in gold (RÖSSLER), A., ii, 733.
- Platinum black** as a compressed powder, electrical conductivity of (STREINTZ), A., ii, 641.
 action of a mixture of benzene vapour and hydrogen on (LUNGE and AKUNOFF), A., i, 543.
- Platinum wires**, fused-in, protection for (PALMAER), A., ii, 8.
- Plumbogummite** (HARTLEY), A., ii, 600.
- Plumieride**, identity of, with agoniadin (FRANCHIMONT), A., i, 680.
- Poisoning** by arsenic, rôle of leucocytes in (BESREDKA), A., ii, 156.
 detection of conine in cases of (VITALI and STROPPA), A., ii, 639.
 detection of nitroprussides in cases of (VENTUROLI), A., ii, 174.
 detection of opium in cases of (MECKE), A., ii, 180.
- Poisons**, chemical behaviour of, in the organism (FRÄNKEL), A., ii, 423.
 effect of, on eye muscles (GUILLERY), A., ii, 95.
 action of certain, on the kidneys (LINDEMANN), A., ii, 492.
 influence of, on the properties of nerve (WEDENSKI), A., ii, 739.
 protoplasmic, influence of, on lymph formation (GIES and ASHER), A., ii, 291.
- Polarisation**. See Electrochemistry and Photochemistry.
- Polonium** (GIESEL), A., ii, 20.
 from pitchblende (P. and S. CURIE), A., ii, 82.
- Polonium rays**, action of the magnetic field on (CURIE), A., ii, 126.
 existence of, doubtful (V. LENGYEL), A., ii, 402.
 See also Radio-active substances under Photochemistry.
- Polyspartic acids** (SCHIFF), A., i, 279.
- Polymethylenes**, cyclic, from Russian petroleum (WISCHIN), A., i, 146.
- Polyprene** (WEBER), A., i, 354.
- Polysaccharides**, hydrolysis of (ŠULC), A., ii, 395.
- Pomegranate root**, alkaloid $C_9H_{17}ON$ from (PICCININI), A., i, 110.
- Pomegranates**, Java, amount of alkaloids in (BECKURTS), A., ii, 563.
- Poplar bud oil** (FICHTER and KATZ), A., i, 108.
- Potassammonium**, action of, on arsenic (HUGOT), A., ii, 14.
- Potassium**, in the red corpuscles of the blood of animals (BOTTAZZI and CAPPELLI), A., ii, 225.
- Potassium amalgams** (KURNAKOFF), A., ii, 277; (GUNTZ and FÉREÉ), A., ii, 540; (KERP and BÖTTGER), A., ii, 656.
- Potassium salts**, isomorphous, crystallography of (CORIO), A., ii, 593.
 solubility curves of mixtures of (TOUREN), A., ii, 396, 530, 646.
- Potassium aluminates** (ALLEN and ROGERS), A., ii, 727; (HERZ), A., ii, 728.
 antimonic, arsenide, bismuthide and stannide, preparation of (LEBEAU), A., ii, 276.
 carbonate, solubility of solutions of, in aqueous ammonia (NEWTN), T., 775; P., 1900, 87.
 influence of the medium on the heat of solution of (GALITZKI), A., ii, 66.
 chlorate, electrolytic formation of (BROCHET), A., ii, 205, 276, 541.
 electrolytic reduction of (VOEGE), A., ii, 185.
 explosion of (BERTHELOT), A., ii, 139.
 action of, on phosphoryl chloride (ODDO), A., i, 92.
 decomposition products of (SODÉAU), T., 142; P., 1899, 157.
 toxicology of (MELTZER), A., ii, 296.
- perchlorate**, estimation of, in alkali nitrates (BLATTNER and BRASSEUR), A., ii, 755.
- chloride**, refraction of solutions of (BENDER), A., ii, 461.
 electrolysis of (BROCHET), A., ii, 205, 276.

- Potassium chloride**, electrical conductivity of solutions of (KOHLRAUSCH and MALTBY), A., ii, 61.
dissociation and dissociation equilibrium of (JAHN), A., ii, 522.
absorption of, from aqueous solution, by colloidal stannic oxide (VAN BEMMELN and KLOBBIE), A., ii, 338; (VAN BEMMELN), A., ii, 466.
and sodium chloride solutions, relationship between the composition of (WILSON), A., ii, 285.
compounds of, with acetylene and cuprous chlorides (CHAVASTELON), A., i, 470.
compounds of, with manganese chlorides (MEYER and BEST), A., ii, 77.
fluoride, compound of, with uranyl fluoride, and the action of hydrogen peroxide on (LORDKIPANIDZE), A., ii, 658.
fluorohyperborate (MELIKOFF and LORDKIPANIDZE), A., ii, 138, 139.
telluriodates (WEINLAND and PRAUSE), A., ii, 399.
iodide, titration of (VINCENT), A., ii, 166.
estimation of (BARRIE), A., ii, 755.
mercuriodide, dissociation of (FRANÇOIS), A., ii, 142.
permanganate, alkaline, as an oxidising agent (DONATH and DITZ), A., i, 197.
action of, on hydrogen peroxide and on Caro's acid (V. BÄYER and VILLIGER), A., ii, 719.
permanganomolybdates and the salts with ammonium (FRIEDHEIM and SAMELSON), A., ii, 547.
nitrate, electrical conductivity of solutions of (KOHLRAUSCH and MALTBY), A., ii, 61.
influence of the medium on the heat of solution of (GALITZKI), A., ii, 66.
formation and transition of mixed crystals of sodium nitrate and (HISSINK), A., ii, 339.
comparative estimations of nitrogen in (V. WISSELL), A., ii, 685.
estimation of potassium perchlorate in (BLATTNER and BRASSEUR), A., ii, 755.
nitrite, presence of, in brown powder residue (SETON and STEVENSON), A., ii, 276.
and cyanide, explosiveness of a mixture of (VAN GEUNS), A., i, 636.
- Potassium nitrite**, decomposition of, by alcoholic sulphur dioxide (DIVERS and HAGA), T., 437, 687.
and nitrate, mixed, solubility of (DIVERS), P., 1900, 40.
palladous iodonitrite (ROSENHEIM and ITZIG), A., ii, 282.
Dipotassium sodium cobaltinitrite (ADIE and WOOD), T., 1076; P., 1900, 17.
Potassium selenoantimonites and thioantimonites and their double salts with metals (POUGET), A., ii, 84.
ammonium silicovanadiomolybdates (FRIEDHEIM and CASTENDYCK), A., ii, 484.
sulphate, test by freezing point determinations of the dissociation values of solutions of (ARCHIBALD), A., ii, 65.
absorption of, from aqueous solution by colloidal stannic oxide (VAN BEMMELN and KLOBBIE), A., ii, 338; (VAN BEMMELN), A., ii, 466.
sulphates, compounds of, with metallic sulphates (MALLET), T., 216; P., 1899, 227.
persulphate, action of, on cobalt salts (MAWROW), A., ii, 596.
chromium sulphate (FAGEL), A., ii, 349.
magnesium sulphate, hydrate of (VAN'T HOFF and KASSATKIN), A., ii, 284.
manganese sulphate (MEYER and BEST), A., ii, 78.
nitrito-hydroximidosulphates (DIVERS and HAGA), T., 432; P., 1900, 54.
sulphazotised salts, Fremy's, identification and constitution of (DIVERS and HAGA), T., 440; P., 1900, 55.
hydrosulphides, sulphides and polysulphides (BLOXAM), T., 753; P., 1899, 146.
sulphite and thiosulphate, double, with silver and copper (ROSENHEIM and STEINHAUSER), A., ii, 652.
hydrogen chloro-oamisulphite (ROSENHEIM), A., ii, 660.
sodium sulphites, non-existence of two isomeric (FRAPS), A., ii, 276.
- Potassium organic compounds**:—
cyanide and nitrite, explosiveness of a mixture of (VAN GEUNS), A., i, 636.
action of, on aliphatic aldehydes (KOHN), A., i, 205.
as a condensing agent (SMITH), A., i, 38.
cobaltocyanide, oxidation of, by atmospheric oxygen (MANCHOT and HERZOG), A., ii, 546.

Potassium organic compounds:—

- ferrocyanide, decomposition of, by sulphuric acid (ADIE and BROWN-ING), T., 150; P., 1899, 226.
- rhodicyanide (LEIDIE), A., i, 212.
- selenocyanide (MUTHMANN and SCHRÖDER), A., i, 479.
- thiocyanate in human saliva (MENDEL and SCHNEIDER), A., ii, 554.
- platosemiallyalcohol chloride (BIILMANN), A., i, 543.
- platosemi-ethylene and -ammine chlorides (JØRGENSEN), A., i, 542.
- palladous oxalonitrite (ROSENHEIM and ITZIG), A., ii, 282.

Potassium, detection and estimation of:—

- detection of (BIILMANN), A., ii, 624.
- microchemical detection of (HUYSE), A., ii, 245.
- phosphotungstic acid as a test for (WÖRNER), A., ii, 370.
- estimation of, by phosphomolybdic acid (WAVELET), A., ii, 758.
- new method of estimating (ADIE and WOOD), T., 1076; P., 1900, 17.
- shortened method for estimating, in its salts (NEUBAUER), A., ii, 759.

Potatoes. See Agricultural Chemistry.

Potentials. See Electrochemistry.

- Powder, brown, composition of the residue of burnt** (SETON and STEVENSON), A., ii, 276.
- smokeless, tests for stability of (HOITSEMA), A., ii, 55.

Pozzuolana, natural and artificial (GEOIGIS and ALVISI), A., ii, 348, 545.

Praseodymium, spectra of (MUTHMANN and STÜTZEL), A., ii, 18.

carbide, preparation and properties of (MOISSAN), A., ii, 726.

- Pregnancy, effect of ingestion of alcohol during** (NICLOUX), A., ii, 416.
- increase of hepatic glycogen during (CHARRIN and GUILLEMONAT), A., ii, 292.
- influence of extract of ovaries on the changes produced in nutrition during (CHARRIN and GUILLEMONAT), A., ii, 554.

Prehnite in metamorphosed limestone (LACROIX), A., ii, 604.

action of ammonium chloride on (CLARKE and STEIGER), A., ii, 414.

Prehnitic acid. See 1:2:3:4-Benzene-tetracarboxylic acid.

Prehnitylic acid. See 2:3:4-Trimethylbenzoic acid.

Pressure and evaporation, relation between (HALL), A., ii, 9.

Propaldehyde, heat of combustion and of formation of (BERTHELOT and DELÉPINE), A., ii, 334.

condensation of, with acetaldehyde (SCHMALZHOFFER), A., i, 626.

Parapropaldehyde, β -iodo- (CHARON and PAIX-SÉAILLES), A., i, 472.

Propane, nitro-, secondary, action of alkalis on (DUNSTAN and GOULDING), T., 1266; P., 1900, 174.

cycloPropane. See Trimethylene.

Propanedicarboxylic acids. See:—
Glutaric acid.

Methylsuccinic acid.

cycloPropanedicarboxylic acid. See Trimethylenedicarboxylic acid.

Propanolmercury salts (SAND and HOFMANN), A., i, 885.

Propenolmercury salts (SAND and HOFMANN), A., i, 886; (HOFMANN and SAND), A., i, 619.

Propiolic acid, iodo-, reactions of (NEF), A., i, 23.

Propionaldazine (FRANKE), A., i, 213.

Propionamide, α -dichlorothio- (TROEGER and EWERS), A., i, 210.

Propionic acid, density of (V. HIRSCH), A., ii, 9.

estimation of, in acetic acid (MUSPRATT), A., ii, 375.

methyl ester, rate of hydrolysis of, at various temperatures (PRICE), A., ii, 528.

Propionic acid, β -chloro-, preparation of, and action of water on (DE BARR), A., i, 76.

α -thiocyano-, esters of, formation and boiling points of (WHEELER and BARNES), A., i, 565.

Propionitrile (ethyl cyanide), specific heat and heat of vaporisation of (LUGININ), A., ii, 334.

p-Propionyl-acetanilide and -aniline (KUNCKELL), A., i, 661.

Propionylaceto- ψ -cumidide, -o-toluidides, and -xylidide, bromo- (KUNCKELL), A., i, 664.

Propionylacetonitrile (HENRY), A., i, 538.

Propionylearbinol (HENRY), A., i, 538.

Propionyl-o-flavaniline (CAMPS), A., i, 310.

p-Propionylphenyl-carbamide, and -carbamie acid, ethyl ester (KUNCKELL), A., i, 665.

Propiophenonedicarboxylic acid (LIMPRIHT), A., i, 600.

β -Propoxy- β -phenylacrylic acid, α -cyano-, ethyl ester (HALLER and BLANC), A., i, 496.

Propyl phosphates, n- and iso-, and their lead and barium salts (CAVALIER and PROST), A., i, 579.

- n*-Propyl isocyanide (WADE), P., 1900, 157.
- β -isoPropylacrylic acid. See Hexenoic acid.
- isoPropylallylaniline and the action of cyanogen bromide on (V. BRAUN), A., i, 642.
- isoPropylamine abnormal aurichloride (FENNER and TAFEL), A., i, 111.
- β -Propylsec. amylhydroxylamine and its hydrochloride (BEWAD), A., i, 631.
- Propylbenzenes, *n*- and *iso*-, refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.
- 1-isoPropylbenzoxazole-4-carboxylic acid, ethyl ester (EINHORN), A., i, 441.
- isoPropylbenzylidenbis-2-methylindole (V. WALTHER and CLEMEN), A., i, 408.
- Propylisobutylamine and its salts (MARCKWALD), A., i, 143.
- isoPropyl butyl ketone and its oxime (NEF), A., i, 350.
- isoPropyl isobutyl ketone and its oxime and oxidation (PONZIO), A., i, 588.
- α -isoPropylbutyric acid. See Heptoic acid.
- Propylcatechol, preparation of (DE-LANGE), A., i, 289.
- 4-isoPropylcoumarone (STOERMER), A., i, 653.
- Propylene, action of, on mercuric salts (SAND and HOFMANN), A., i, 385.
- Propylene glycol, biochemical oxidation of (KLING), A., i, 129.
- mercuric salts (HOFMANN and SAND), A., i, 618.
- β -isoPropylglutaric acid (hexanedicarboxylic acid) (HOWLES, THORPE, and UDALL), T., 942; P., 1900, 115.
- β -isoPropylheptane- ϵ -oleic acid, lactone of (V. BAERER and VILLIGER), A., i, 183.
- 5-isoPropylheptanone-2-nitrile-7, and its isomeride (MAHLA and TIEMANN), A., i, 507.
- β -Propyl-sec.- and -tert.-hexylhydroxylamines and their salts (BEWAD), A., i, 631.
- isoPropylideneacetone. See Mesityl oxide.
- isoPropylidenediethylsulphone. See Sulphonal.
- α -isoPropylidene- γ -hexenoic acid (RUPE), A., i, 372.
- isoPropylkatoocoumarancarboxylic acid, ethyl ester (BISCHOFF), A., i, 397.
- β -isoPropylsevalic acid from the oxidation of the keto-lactone, $C_{10}H_{16}O_3$ (SEMMLER), A., i, 240.
- Propylmalonic acid (butanedicarboxylic acid), bromo-, and $\alpha\beta$ -dibromo-, synthesis with (WILLSTÄTTER), A., i, 405.
- p*-isoPropylphenoxy-acetal, and -aldehyde hydrate and its semicarbazone and thiosemicarbazone (STOERMER), A., i, 653.
- 4-*p*-isoPropylphenyldihydrodithiazine, 2,6-dicyano- (HELLSING), A., i, 518.
- β -*p*-isoPropylphenyl- α -methylhydroacrylic acid, synthesis of; and its salts (GRIGOROWITSCH), A., i, 597.
- Propylisopropylaniline, and the action of cyanogen bromide on (V. BRAUN), A., i, 642.
- $\alpha\alpha$ -Propylisopropylsuccinic acids, *cis*- and *trans*- (octanedicarboxylic acids), preparation and properties of (BONE and SPRANKLING), T., 654; P., 1900, 71.
- isoPropylpyrrolidone (TAFEL and STERN), A., i, 558.
- isoPropylstilbene, and *p*-nitro- (V. WALTHER and WETZLICH), A., i, 438.
- isoPropylsuccinimide (TAFEL and STERN), A., i, 558.
- Prostatic secretion, properties of (CAMUS and GLEY), A., ii, 674.
- action of, on the liquid of the vesicular seminales (CAMUS and GLEY), A., ii, 673.
- Protamine, a new—cyclopterine (MOR-KOWIN), A., i, 72.
- Protamines, classification of (KOSSEL and KUTSCHER), A., i, 466.
- and their decomposition products, physiological action of (THOMPSON), A., ii, 227.
- Proteids (albuminoids), classification of (KOSSEL and KUTSCHER), A., i, 466.
- coagulation temperature of (PAULI), A., i, 265.
- influence of nitrogenous substances on the heat-coagulation of (SPIRO), A., i, 615.
- reversible liquefaction of (TSVETIT), A., i, 67.
- pressure filtration of (HARRIS), A., ii, 222.
- the condition of nitrogen in (HAUSMANN), A., i, 317.
- amount of nitrogen obtainable from, by acids (HENDERSON), A., i, 265.
- decomposition of, by acids (BOKORNY), A., i, 126.
- fermentative decomposition of (JACOBY), A., ii, 671.
- formation of alcohol in the putrefaction of, free from carbohydrates (VITALI), A., ii, 297.
- action of alcohol on (ROSEMAN), A., ii, 92, 356.
- first cleavage product of the action of alkali on (MAAS), A., i, 708.

Proteids (*albuminoids*), behaviour of, to alkaloid reagents (COHNHEIM and KRIEGER), A., ii, 778.
 digestion of, by pepsin and trypsin, influence of alcohols on (LABORDE), A., ii, 151.
 action of arginine on the tryptic digestion of (LAWROFF), A., ii, 28.
 fat from (PFLÜGER), A., ii, 91, 92.
 origin of glycogen from (SCHÜNDORFF), A., ii, 740.
 tyrosine from (REACH), A., i, 126.
 influence of, on animals (PFLÜGER), A., ii, 91.
 absorption of, after feeding on meat and plasmon (MICKO), A., ii, 422.
 rate of absorption and of assimilation of, during fasting (MOSSO), A., ii, 605.
 fate of, when introduced into the circulation (MUNK and LEWANDOWSKY), A., ii, 154.
 and flesh, energy-value of (PFLÜGER), A., ii, 417.
 feeding value of (PFLÜGER), A., ii, 91, 92.
 iodine number of (BLUM), A., i, 67.
 formation of, in plants (EMMERLING), A., ii, 612.
 influence of light on the production of, in plants (PALLADIN), A., ii, 612.
 insoluble in gastric juice, conditions of the production of, and their importance for the respiration of plants (PALLADIN), A., ii, 613.
 plant, regeneration of, from their products of decomposition (PRIANISCHNIKOFF), A., ii, 233.
 ion-, compounds (LOEB), A., ii, 227.
 in albuminuria, origin of the (CLOËTTA), A., ii, 155.
 of blood and lymph, action of lymphagogues on (TIMOFÉFFSKY), A., ii, 95.
 of conifer seeds, decomposition products of (SCHULZE and WINTERSTEIN), A., ii, 101.
 of coniferous plants (SUZUKI), A., ii, 562.
 of cows' milk (STORCH), A., i, 266.
 of egg white, composition of (OSBORNE and CAMPBELL), A., i, 574.
 of egg yolk (OSBORNE and CAMPBELL), A., i, 616.
 of ovarian colloid (PANZER), A., i, 70.
 in the vegetative portions of plants (BOKORNY), A., ii, 426.
 of *Lupinus luteus* seedlings, decomposition products of (SCHULZE), A., ii, 101.

Proteids (*albuminoids*), coagulable, of connective tissues (GIES and RICHARDS), A., ii, 292.
 histon-like, from the thymus gland (FLEROFF), A., i, 71.
 of the wheat germ (OSBORNE and CAMPBELL), A., i, 573.
 test for (LINTNER), A., ii, 631.
 modification of Ritthausen's method of estimating (BARNSTEIN), A., ii, 779.
 precipitation of (SCHJERNING), A., ii, 779.
 animal, detection of glutamic acid in, by sulphuric acid (KUTSCHER), A., i, 67.
 estimation of absorbable, in foods (BÜLOW), A., ii, 549.
 separation of, from flesh-bases (WILEY), A., ii, 122.

Proteids. See also :—

Albumin.
 Albumin.
 Albumoses.
 Antipeptone.
 Casein.
 Caseinogen.
 Columbinin.
 Cystin.
 Edestin.
 Elastin.
 Fibrin.
 Globulin.
 Glucoproteids.
 Glutininpeptone.
 Hæmoglobins.
 Histon.
 Lecithin.
 Nucleins.
 Nucleons.
 Oxyprotein.
 Paranuclein.
 Peptones.
 Plasmon.
 Thymine.
 Vitellin.

Protoalbumose. See Albumose.

Protocatechuic acid (3:4-dihydroxybenzoic acid), thermal study of (MASSOL), A., i, 600.
 from the fusion with alkalis of certain colouring matters from tannins (PERKIN), T., 424; P., 1900, 45.
 ethyl ester, nitro- and amino- (EINHORN), A., i, 440.
Protopine (*macleyine*) (MURRILL and SCHLOTTERBECK), A., i, 686.
Protoveratrine, action of, on muscle and nerve (WALLER), A., ii, 425.
Pseudo-acids and their salts (FULDA), A., i, 36.
 characterisation of (HANTZSCH), A., i, 94.

- Pseudo-acids**, α -oximinoketones and quinoneoximes as (FARMER and HANTZSCH), A., i, 103.
- Pseudo-bases**, azonium bases as (HANTZSCH and KALB), A., i, 114. diazohydroxides as (ENGLER and HANTZSCH), A., i, 566.
- Pseudo-ammonium bases and salts** (HANTZSCH and KALB), A., i, 113. transformation of colour-bases into (HANTZSCH and OSSWALD), A., i, 256.
- Pseudo-cyanides** (HANTZSCH and KALB), A., i, 114; (HANTZSCH and OSSWALD), A., i, 256.
- Pseudodiazonium compounds**, diazo-compounds as (HANTZSCH), A., i, 126.
- Pseudo-nuclein**, comparison of natural and artificial (GIERTZ), A., i, 71.
- Pseudo-salts**, characteristics of (HANTZSCH and KALB), A., i, 557. diazocyanides as (HANTZSCH), A., i, 567.
- Pseudosulphonic acids**, transformation of colour-bases into (HANTZSCH and OSSWALD), A., i, 257.
- Pseudo-terpenes**, -terpene alcohols, and -terpene ketones (SEMMLER), A., i, 453.
- Ptomaine**, resembling aconitine, from a corpse (MECKE), A., ii, 120.
- Pulegone** and α - and β -*iso*Pulegone (HARRIES and ROEDER), A., i, 182.
- Pulegone**, oxidation of (MARKOWNIKOFF), A., i, 475. metabolism during poisoning with (LINDEMANN), A., ii, 223. reactions of (KLAGES), A., i, 44.
- Pump**, water vacuum, modification of the (ITTNER), A., ii, 718.
- Purine bases**, estimation of, in blood and animal organs (HIS and HAGEN), A., ii, 769. derivatives, a quantitative reaction of (JOLLES), A., ii, 454, 636. separation of, from urea (KRÜGER and SCHMIDT), A., ii, 81. substances, rôle of, in human metabolism (BURIAN and SCHUR), A., ii, 489.
- isoPurpuric acid**, constitution of (NIETZKI and PETRI), A., i, 485.
- Metapurpuric acid**, constitution of (BORSCHKE), A., i, 645.
- Pycnometer**, new (GÖCKEL), A., ii, 193.
- Pyocyanin**, the blue colouring matter of *Bacillus pyocyanus* (BOLAND), A., i, 70.
- Pyramidone** (*dimethylaminodimethylpyrazolone*), reactions of (HOFFMANN), A., ii, 379.
- Pyrazole-3:5-dicarboxylic acid** (GRAY), A., i, 376.
- Pyrazoledimethylenedinitrophenol** (v. PECHMANN), A., i, 313.
- Pyrazolinedimethylenepieryl acetate** (v. PECHMANN), A., i, 313.
- Pyridine**, action of, on bromoacetophenone (SCHMIDT and HARTONG VAN ARK), A., i, 687. action of sulphur dioxide and hydrogen sulphide on (ANDRÉ), A., i, 517. tellurium bromide and chloride (LENHER), A., i, 379. thori-chloride and -bromide (ROSENHEIM and SCHILLING), A., ii, 351. hydrochloride, double salt of, with bismuth chloride (HAUSER and VANINO), A., i, 641. tri- and tetra-thionates (ANDRÉ), A., i, 517. detection of (VONGERICHTEN), A., i, 51.
- Pyridine**, chlorine derivatives of, constitution of (SELL and DOOTSON), T., 1, 233; P., 1899, 205; 1900, 9. chloroamino-derivatives of, constitution of (SELL and DOOTSON), T., 4, 283, 771; P., 1899, 206; 1900, 9, 111.
- Pyridineacetophenone** and its salts and oxime chloride (SCHMIDT and HARTONG VAN ARK), A., i, 687.
- Pyridinebetaine** and its basic hydriodide (ORTOLEVA), A., i, 558.
- Pyridine-4-carboxylic acid**. See *iso*-Nicotinic acid.
- Pyridinecarboxylic acids** (PINNER), A., i, 409.
- Pyridine-2:6-dicarboxylic acid** (PINNER; PINNER and LEWIN), A., i, 409.
- Pyridinium penta-bromo- and -chlorochromate** (PFEIFFER), A., i, 559.
- Pyridoyl acetic acids**, α -, β -, and γ -, ethyl esters (PINNER), A., i, 409.
- 2-Pyridyl mercaptan**, methosulphide and sulphides (MARCKWALD, KLEMM, and TRABERT), A., i, 456.
- Pyridyl-2-methylsulphone**, -2-sulphonic acid, and -2-thioglycollic acid (MARCKWALD, KLEMM, and TRABERT), A., i, 456.
- Pyrites**, composition and heat of combustion of (CAVAZZI), A., ii, 598. estimation of pyrrhotite in (CARPENTER), A., ii, 763. estimation of sulphur in (HEIDENREICH), A., ii, 810.
- Pyrogallolsulphonic acid** and its salts (DELAGE), A., i, 595.
- Pyrographitic acid**, insoluble (STAUDENMAIER), A., ii, 15.
- Pyrojapaconine**, preparation, properties and aurichloride of (DUNSTAN and READ), T., 62; P., 1899, 207.

Pyrojapaconitine, preparation, properties, hydrolysis, and salts of (DUNSTAN and READ), T., 60 ; P., 1899, 207.

Pyrolusite from Moravia (KOVÁŘ), A., ii, 147.

Pyromeconic acid, constitution of (PERATONER and LEONARDI), A., i, 550.

Pyromucic acid, oxidation of, in presence of ferrous salts (FENTON and JONES), T., 76 ; P., 1899, 224.

isoPyromucic acid (SIMON), A., i, 198.

Pyromucosethylamide (WHEELER and ATWATER), A., i, 294.

α -Pyrone- α' -carboxylic acid (LAFWORTH), P., 1900, 132.

Pyrope from Steinegg, Austria (MRHA), A., ii, 218.

Pyrophyllite from North Carolina (CLARKE and STEIGER), A., ii, 24.
from Westanå, Sweden (WEIBULL), A., ii, 286.

Pyrotartaric acid. See Methylsuccinic acid.

n-Pyrotartaric acid. See Glutaric acid.

isoPyrotartaric acid (SIMON), A., i, 624.
ferric salt, as an indicator (SIMON), A., i, 625.

Pyroxene. See Augite.

Pyrrhotite (*magnetic pyrites*), estimation of, in pyrites ore (CARPENTER), A., ii, 763.

Pyrrrole-2-aldehyde and **Pyrrrolealdoxime** (BAMBERGER and DJIERDJIAN), A., i, 309.

2-Pyrrolidinecarboxylic acid and the action of methylamine on (WILLSTÄTTER), A., i, 405.

Pyrrrolidone and its mercury and bromo-derivatives (TAFEL and STERN), A., i, 557.

Pyrrroline-2-carboxylic acid (BAMBERGER and DJIERDJIAN), A., i, 309.
hydrazide of (PICCININI and SALMONI), A., i, 562.

2-Pyrrrolyl-ascimide and **-hydrazide** (PICCININI and SALMONI), A., i, 562.

2-Pyrrrolylurethane, and its nitroso- and acetyl-derivatives (PICCININI and SALMONI), A., i, 562.

Pyruvamide, oxime of (WHITELEY), T., 1045 ; P., 1900, 145.

Pyruvic acid, mercury salts and derivatives of (LEY), A., i, 382.
benzylhydrazones of (CURTIUS), A., i, 611.

4-quinaldylhydrazone of (MARCKWALD and CHAIN), A., i, 522.

Pyruvoylcollic acid, phenylhydrazone of (WOLFF and HEROLD), A., i, 585.

Q.

Quartz, solubility of, in sodium silicate solutions (SPEZIA), A., ii, 595.

Quassia, distinguishing between hops and (CHAPMAN), A., ii, 380.

Quercetin from various tannin matters (PERKIN), T., 423 ; P., 1900, 45.

4-Quinaldyl-hydrazine, and **-phenylthio-semicarbaside** (MARCKWALD and CHAIN), A., i, 521.

Quinizarin, bromine-derivatives of (LIEBERMANN and RIIBER), A., i, 451.

Quinobis- α -oxy-propionic, **-butyric**, and **-isovaleric acids** (BISCHOFF), A., i, 446.

Quinol, $C_{12}H_7O_2Cl_2$, from trichloroguaiacol and nitric acid (COUSIN), A., i, 487.

Quinol (1:4-*dihydroxybenzene*), condensation of the disodium derivative of, with esters of α -bromo-fatty acids (BISCHOFF), A., i, 446.

chloro-, **diacetyl** derivative of (THIELE and WINTER), A., i, 504.

o-dicyano- (THIELE and MEISENHEIMER), A., i, 299.

Quinolacetic acid. See *p*-Hydroxy-phenoxyacetic acid.

Quinoline derivatives, action of aldehydes on (KOENIGS), A., i, 189.

abnormal aurichloride (FENNER and TAFEL), A., i, 111.

hydrochloride, double salt of, with bismuth chloride (HAUSER and VANINO), A., i, 641.

methiodide (MARCKWALD and MEYER), A., i, 519.

tellurium bromide and **chloride** (LENHER), A., i, 379.

Quinoline, 6-amino-, and its acetyl, benzoyl and thionyl derivatives (KNUEPPEL), A., i, 187.

isoQuinoline derivatives, formation of (GABRIEL and COLMAN), A., i, 358.

1-mono- and **1:4-di-chloro-**, and its tetrahydride (GABRIEL and COLMAN), A., i, 358.

4-Quinolinealdehyde (KOENIGS), A., i, 246.

Quinoline-phenol, **-phenetole** and its **dicarboxylic acid** (KOENIGS), A., i, 247.

Quinolinic acid, esterification of (KIRPAL), A., i, 51.

2-Quinolones, **nitro-**, preparation of (DECKER), A., i, 689.

2-Quinolylhydrazine and its derivatives and its compounds with ethyl oxalate (MARCKWALD and MEYER), A., i, 519.

6-Quinolylhydrazine (KNUEPPEL), A., i, 188.

3-Quinolyl-phenylthiosemicarbazide and -semicarbazide (MARCKWALD and MEYER), A., i, 520.

Quinone, $C_{12}H_6O_4Cl_2$, from trichloroguaiacol and nitric acid (COUSIN), A., i, 487.

Quinone, production of, by *Streptothrix chromogena* (BEYERINCK), A., ii, 425.

addition of hydrogen cyanide to (THIELE and MEISENHEIMER), A., i, 299.

o-Quinone, tetra-bromo- and -chloro-, from tetra-bromo- and -chloro-guaiacol and -veratrol (COUSIN), A., i, 179, 487.

Quinonedioximes, action of nitrogen peroxide on (OLIVERI-TORTORICI), A., i, 558.

Quinones, action of acetic anhydride and sulphuric acid on (THIELE and WINTER), A., i, 504.

from benzene, estimation of, volumetrically (VALEUR), A., ii, 57.

Quinones, chloro-derivatives of, action of α -acylated phenylhydrazines on (McPHERSON and FISCHER), A., i, 411.

Quinones, list of. See Ketones and Quinones.

Quinonesacetylphenylhydrazones (McPHERSON), A., i, 123.

Quinoneshydrazones, constitution and derivatives of (FARMER and HANTZSCH), A., i, 122.

Quinonesoximes, stereochemistry of (KEHRMANN and KRÜGER), A., i, 180.

as pseudo-acids (FARMER and HANTZSCH), A., i, 103.

Quinopyridines, constitution and nomenclature of (WILLGERODT), A., i, 610.

Quinoquinoline, anhydrous chloride of, phototrophy of (MARCKWALD), A., ii, 2.

Quinoseol, composition of (ROST), A., ii, 154.

See also *o*-Hydroxyquinolinesulphonic acid.

Quinoxalidoneacetic acid, ethyl ester (RUHEMANN and STAPLETON), T., 243; P., 1900, 12.

6-Quinylurethane (KNEUPPEL), A., i, 188.

R.

Racemic acid. See under Tartaric acid.

Racemic amino-acids, resolution of, into optically active components (FISCHER), A., i, 172, 646; (FISCHER and MOUNEYRAT), A., i, 647.

Racemic compounds, some (SCHLOSSBERG), A., i, 376.

and stereoisomerides (COOPER), A., ii, 269.

characterisation of (ROOZEBOOM), A., ii, 64, 70, 132; (BRUNI), A., ii, 269;

(ADRIANI), A., ii, 462.

resolution of, into their active components (WALDEN), A., i, 7; (MARCKWALD and MCKENZIE), A., i, 207.

resolution of, into active components, by means of enzymes (FISCHER), A., i, 140.

resolution of, by means of moulds (ULPIANI and CONDELLI), A., ii, 493.

Racemisation occurring during the formation of benzylidene, benzoyl, and acetyl derivatives of *d*-ac-tetrahydro- β -naphthylamine (POPE and HARVEY), P., 1900, 74.

of optically active tin compounds (POPE and PEACHEY), P., 1900, 116.

Radiations and Radio-activity. See Photochemistry.

Radium (GIESEL), A., ii, 19.

existence of, doubtful (v. LENGYEL), A., ii, 402.

from pitchblende (P. and S. CURIE and BÉMONT), A., ii, 82.

radiations from (VILLARD), A., ii, 381.

transparency of aluminium to (BECQUEREL), A., ii, 381.

spectrum of (DEMARÇAY), A., ii, 83, 586; (RUNGE), A., ii, 641.

electric charge of the deviable rays of (P. and S. CURIE), A., ii, 254.

effect of the magnetic field on rays of (CURIE), A., ii, 126; (BECQUEREL), A., ii, 182, 183.

phosphorescence produced by radiations from (BECQUEREL), A., ii, 126.

behaviour of, at low temperatures (BEHRENDSEN), A., ii, 587.

See also Radio-active substances under Photochemistry.

Raffinose (*melitose*, *melitriose*), nutritive value of, for *Aspergillus niger* (GILLOT), A., ii, 99.

Rain-water. See under Water.

Ransättite (WEIBULL), A., ii, 287.

Rape cake. See Agricultural Chemistry.

Rat, growing, decrease of water in the central nervous system of the (DONALDSON), A., ii, 556.

Rate of substitution of a nitro-group by an alkoxy (DE BRUYN), A., i, 146.

Rathite from the Binnenthal (SOLLY and JACKSON), A., ii, 599.

Rays. See Photochemistry.

- Realgar.** See Arsenic sulphide.
- Receiver for fractional distillation in a vacuum** (FOGETTI), A., ii, 535.
- Reductor**, a simplified (SHIMER), A., ii, 50.
- Refraction.** See Photochemistry.
- Resin oil**, distillation of, under pressure (KRAEMER and SPILKER), A., i, 617.
- Resin from acetone, isoamyl nitrite and hydrogen chloride** (KISSEL), A., i, 621.
- (rosin), properties of (SMETHAM and DODD), A., ii, 377.
- Resins**, natural (BAMBERGER and LANDSIEDL), A., i, 48; (BAMBERGER and VISCHNER), A., i, 605.
- examination of (DIETERICH), A., ii, 118.
- Resins.** See also:—
- Abietoresen.
 - Ambrite.
 - Ammoniacum.
 - Anime.
 - Bdellium.
 - Canadorezen.
 - Caranna.
 - Dammar.
 - Galbanum.
 - Labdanum.
 - Lariciresinol.
 - isoLariciresinol.
 - Mastic.
 - Opoponax.
 - Sagapenum.
 - Sandarac.
 - Storax.
 - Tacamahaca.
 - Turpeth.
- Resorcinobis- α -oxy-propionic, -butyric, and -isovaleric acids and their ethyl esters** (BISCHOFF), A., i, 446.
- Resorcinol**, action of cyanogen bromide on (SCHOLL and NÖRR), A., i, 436.
- condensation of the disodium derivative of, with esters of α -bromo-fatty acids (BISCHOFF), A., i, 446.
- methyl ether, preparation of (MERZ and STRASSER), A., i, 289.
- Resorcinolacetic acid** See *m*-Hydroxy-phenoxyacetic acid.
- Resorcinol- α -azosalicylic acid** (ZAHN), A., i, 549.
- Resorcinol-1:3:5-tricarboxylic acid.** See Dihydroxytrimelic acid.
- Respiration**, action of the blood-gases on (PLAVEC), A., ii, 288.
- action of morphine on (WINTERNITZ), A., ii, 221, 489; (IMPENS), A., ii, 228.
- action of nicotine on (WINTERBERG), A., ii, 424.
- Respiration**, elimination of carbon dioxide during (GRANDIS), A., ii, 604.
- in the frog (ATHANASIU), A., ii, 288.
- of plants. See Agricultural Chemistry.
- Retene**, refraction of (CHILESOTTI), A., i, 339.
- Rhabarberone and Rhabarberohydroanthrone** (HESSE), A., i, 41; (LIEBERMANN), A., i, 355.
- Rhamninase** (C. and G. TANRET), A., i, 185.
- Rhamninose, Rhamnite and Rhamninotriconic acid** (C. and G. TANRET), A., i, 78.
- Rhamninose and Rhamninotriconic acid**, Tanret's, cryoscopy of (PONSOT), A., i, 333.
- Rhamnose**, oxidation of, by hydrogen peroxide (MORRELL and CROFTS), T., 1220; P., 1900, 171.
- Rhamnus cathartica*, constituents of the fruits of (TSCHIRCH and POLACCO), A., i, 681.
- Rhapontin and its tetracetyl derivative** (HESSE), A., i, 41.
- Rhein and its diacetyl derivative** (HESSE), A., i, 41; (LIEBERMANN), A., i, 355.
- Rhodoose**, a new sugar (VOTOČEK), A., i, 332.
- Rhodinal**, transformation of, into menthone (BOUVEAULT), A., i, 452.
- Rhodinol** (BOUVEAULT), A., i, 452.
- Rhodium**, behaviour of, in alloys with the noble metals (RÖSSLER), A., ii, 732.
- sesquichloride* (LEIDIŠ), A., ii, 146.
- potassium cyanide* (LEIDIŠ), A., i, 212.
- Rhubarb and its active constituents** (HESSE), A., i, 40; (TSCHIRCH), A., i, 185.
- Rhus Metopium*, constituents of (PERKIN), T., 427; P., 1900, 45.
- Ricinine and its dibromide** (EVANS), A., i, 309.
- Ricinoleic acid**, and its acetyl derivative, action of hydrogen bromide on (KASANSKY), A., i, 426.
- Ring compounds**, formation of, by elimination of aromatic nitro-groups (WERNER and HERBERGER), A., i, 57.
- luminescence of (KAUFFMANN), A., i, 480.
- Ring disruption and ring formation among terpene derivatives** (WALLACH), A., i, 44, 589.
- Roasting apparatus**, laboratory (DROSSBACH), A., ii, 270.
- Robinia Pseudacacia*, constituents of (PERKIN), T., 430; P., 1900, 45.

- Rocks**, artificial production of (BAUER), A., ii, 26.
 application of the phase rule to (LE CHATELIER), A., ii, 197.
 corundum-bearing, of Eastern Ontario (MILLER), A., ii, 552.
 volcanic, Italian, composition of (WASHINGTON), A., ii, 27, 220.
 from Sumatra (MILCH), A., ii, 150.
 of Suzeava, composition of minerals from the (BUTUREANU), A., ii, 149.
 analysis of (WÜLFING), A., ii, 25.
- Rock analyses**, statement of (WASHINGTON), A., ii, 598.
- Röntgen rays**. See Photochemistry.
- Resaniline bases**, coloured, and their colouring properties (v. GEORGIEVICS), A., i, 569.
- Rose blossoms**, occurrence of phenylethyl alcohol in (WALBAUM), A., i, 509, 645.
- Roses**, oil of (WALBAUM), A., i, 509.
 German (WALBAUM and STEPHAN), A., i, 677.
 benzylcarbinol from (v. SODEN and ROJAHN), A., i, 489.
- Rosindone**, chloro- and thio- (FISCHER and HEPP), A., i, 461.
- iso***Rosindone**, its oxime and salts, and the interaction of the chloride with aniline and the toluidines (FISCHER and HEPP), A., i, 461.
- Rosinduline** (FISCHER and HEPP), A., i, 460.
- Rosinduline** and *iso***Rosinduline**, action of tetramethyldiaminobenzhydrol on (MÖHLAU and SCHAPOSCHNIKOFF), A., i, 367.
- iso***Rosindulines**, eighth and ninth isomerides, isolation of, and their salts (KEHRMANN and FILATOFF), A., i, 60.
 tenth and eleventh isomerides of (KEHRMANN and WOLFF), A., i, 463.
- iso***Rosindulineleucauramine** and its salts (MÖHLAU and SCHAPOSCHNIKOFF), A., i, 367.
- Rubber wares**. See Caoutchouc.
- Rubeanic acid**. See Oxamide, dithio-.
- Rubidium**, change of volume accompanying fusion of (ECKARDT), A., ii, 400.
- Rubidium amalgams** (KERP and BÜTTGER), A., ii, 656.
- Rubidium salts**, extraction of, from lepidolite (FORMÁNEK), A., ii, 15.
- Rubidium hydrogen tetrafluoridate** (WEINLAND and KÖPPEN), A., ii, 139.
 telluridate (WEINLAND and PRAUSE), A., ii, 399.
- Rubidium persulphate** (MARSHALL), A., ii, 277.
 magnesium sulphate (MALLETT), T., 223 ; P., 1899, 227.
 microchemical detection of (HUYSSSE), A., ii, 245.
- Ruminants**. See Agricultural Chemistry.
- Ruthenium** and its compounds (ANTONY and LUCCHESI), A., ii, 659.
- Rye**. See Agricultural Chemistry.
- S.**
- Sabinene**, and its glycol and ketone, and **Sabinenic acid** (SEMMLER), A., i, 454.
- Sabinol** (FROMM), A., i, 402 ; (SEMMLER), A., i, 453.
- Sabinylglycerol** (SEMMLER), A., i, 453.
- Saccharic acid**, oxidation of, in presence of ferrous salts (FENTON and JONES), T., 76 ; P., 1899, 224.
- "**Saccharin**" (o-benzoic sulphinide), influence of, on digestion (BERLIOZ), A., ii, 606.
 detection of, in beer (RÖSSING), A., ii, 119.
 detection of, in food (TRUCHON), A., ii, 377 ; (DE BRÉVANS), A., ii, 635.
 detection of, in wines (VITALI), A., ii, 57.
- Saccharine liquids**, analysis of (HALPHEN), A., ii, 694.
- Saccharomyces mycoderma*, action of benzylthiocarbimide on (TER MEULEN), A., i, 511.
- Saccharose**. See Sucrose.
- Safflower oil**. See *Carthamus tinctorius*.
- Saffron**, colouring matter of (HILGER), A., i, 682.
- Safranine** (FISCHER and HEPP), A., i, 460.
 diazotisation of (JAUBERT), A., i, 315.
- Safranine colouring matters**, structure of (GREEN), A., i, 119.
- apo***Safranine** hydrobromide and *apo*-**Safranone** salts and oxime (FISCHER and HEPP), A., i, 460.
- Safranines**, formation of (HARDIN), A., i, 412 ; (CHARDIN), A., i, 610.
- Safrole**, action of iodine and mercuric oxide on (BOUGAULT), A., i, 641.
- iso***Safrole**, acid, $C_{10}H_{10}O_4$, from the oxidation of (BOUGAULT), A., i, 495.
- Sagapenum**, examination of (DIETERICH), A., ii, 118.
- Sainfoin**. See Agricultural Chemistry.
- St. Ignatius bean**, composition of the albumen of (BOURQUELOT and LAURENT), A., ii, 498.
- "**Sake**," chemical and biological researches on the preparation of (KOZAI), A., ii, 743.

- Salamander**, alkaloids from the (FAUST), A., i, 186.
- Salicylaldehyde**, action of liver-extracts on (MEDVEDEFF), A., ii, 738.
condensation of, with homologous phloroglucinols (WEIDEL and WENZEL), A., i, 308.
- Salicylaldehyde**, 3:5-dibromo-, acetyl derivatives of (SIMONIS and WENZEL), A., i, 496.
- Salicylaldehydophenylhydrazones**, oxidation of (MINUNNI and CARTA-SATTA), A., i, 260.
- Salicylanilinoacetic acid**. See *o*-Carboxyphenylglycollic acid anilide.
- Salicylhydramide**, metallic derivatives of (DELEPINE), A., i, 177.
- Salicylic acid**, action of dry silver oxide and methyl iodide on (LANDER), T., 745; P., 1900, 6, 90.
mercury derivative of, and detection of, by Millon's reagent (LINTNER), A., ii, 631.
sodium salt, influence of, on metabolism (GOODBODY), A., ii, 670.
detection of, in presence of citric acid (LANGKOPF), A., ii, 695, 769; (CONRADY; GEROCK), A., ii, 769; (KLETT), A., ii, 770.
detection of, in milk (SÜSS), A., ii, 770.
cause of error in testing for, in wines (FERREIRA DA SILVA), A., ii, 695.
estimation of (MESSINGER), A., ii, 514.
estimation of, by ferric isopyrotritarate (SIMON), A., i, 625.
- Salicylic acid**, methyl ester, action of aniline and hydroxylamine on (TINGLE), A., i, 544.
phenyl ester. See Salol.
esters of, reaction of, with amines (TINGLE), A., i, 641.
- Salicylic acid**, amino-, glycinyl derivatives of the esters of (EINHORN and OPPENHEIMER), A., i, 494.
- 3-amino-**, derivatives of (ZAHN), A., i, 549.
- m-nitro-** (HILL, SOCH, and OENSLAGER), A., i, 538.
- α*-Salicyloxy-propionic**, ***n*-** and ***iso*-butyric**, and ***iso*-valeric acids** and their ethyl esters (BISCHOFF), A., i, 397.
- Salinigrin**, new glucoside from willow bark (JOWETT), T., 707; P., 1900, 89.
- Salipyrine**, metallic derivatives of constitution of (SCHUYTEN), A., i, 57; (BOURGEOIS), A., i, 193.
estimation of (BOUGAULT), A., i, 311.
- Saliva**, influence of acids on the amylolytic action of (HANFORD), A., ii, 666.
human, potassium thiocyanate in (MENDEL and SCHNEIDER), A., ii, 554.
- Salol**, action of amines, phenols, and sulphuric acid on (COHN), A., i, 548.
- Salt**, a, from Lake Djouvan-Tubé (MARKOWNIKOFF), A., ii, 660.
- Salts**, mixture of, having one common ion, solubility of (TOUREN), A., ii, 396, 530, 646.
acid, relation between taste and dissociation of (KAHLENBERG), A., ii, 270, 646; (RICHARDS), A., ii, 391.
fused, electrolysis of (LORENZ and HELFENSTEIN), A., ii, 833; (HELFENSTEIN), A., ii, 833; (QUINCKE; LORENZ), A., ii, 644.
solid and fused, relation between polarisation and current density in (GOCKEL), A., ii, 704.
solid, and their solution, difference of potential between (CAMPETTI), A., ii, 704.
inorganic, in non-aqueous solutions, electrical conductivity of (LINCOLN), A., ii, 6.
- Samandarine and Samandaridine** (FAUST), A., i, 186.
- Samarium** (DEMARÇAY), A., ii, 404.
oxide, crude, new element in (DEMARÇAY), A., ii, 481.
- Sand**, estimation of, in clays (CRONQUIST), A., ii, 171.
separation of, from clay in soils (SCARLATA), A., ii, 368.
- Sandalwood oil**, East Indian, constituents of (GUERBET), A., i, 242, 401; (v. SODEN; MÜLLER), A., i, 677.
West Indian, constituents of (v. SODEN), A., i, 401; (DEUSSEN), A., ii, 579.
- Sandarac resin**, examination of (DIETRICH), A., ii, 118.
- Sandmeyer's and Gattermann's reactions**, electrolytic modification of (VOTOČEK and ZENŠEK), A., i, 19.
- Sandstone** concretions from West Cheshire (MOORE), A., ii, 150.
- Sanidine** from Monte Cimino, Rome (ZAMBONINI), A., ii, 603.
- Santalene**, **Santalols**, **Santalal**, **Santalie acid** from Bombay oil of sandalwood (GUERBET), A., i, 242.
- Santalenes**, ***α*-** and ***β*-** (GUERBET), A., i, 242, 401.
- iso*Santalenes**, isomeric (GUERBET), A., i, 402.
- Santalol** from West Indian sandalwood oil (DEUSSEN), A., ii, 579.
- Santalols**, ***α*-** and ***β*-** (GUERBET), A., i, 242, 402; (v. SODEN), A., i, 677.
- Santalone** and its oxime from East Indian sandalwood oil (MÜLLER), A., i, 678.

- Santene**, C_9H_{14} , from East Indian sandalwood oil (MÜLLER), A., i, 678.
- Santonie acid**, and its dioxime and **Meta-santonie acid** (FRANCESCONI), A., i, 101.
- Santonin**, action of, on vision (FILEHNE), A., ii, 424.
estimation of (THAETER), A., ii, 122, 775; (KATZ), A., ii, 583.
- α -Santonin**, tribromo- (FRANCESCONI), A., i, 102
- Saponification**, the theory of (LEWKOWITSCH), P., 1899, 190.
See also Hydrolysis.
- Saponite** from Moravia (KOVÁŘ), A., ii, 149.
- Sartorite** from the Binnenthal (SOLLY and JACKSON), A., ii, 599.
- Saturation sludge**, acids in (ANDRLÍK), A., ii, 679.
- Savin**, oil of, constituents of (FROMM), A., i, 402.
- Saw palmette** (*sabal serrulatum*), fruit of (SHERMAN and BRIGGS), A., ii, 102.
- Schinoxidase** from *Schinus molle*, and the function of iron in (SARTHOU), A., i, 575.
- Schisolite** from Greenland (WINTER), A., ii, 418.
- Schröterite** from Saalfeld, Thuringia (ZAMBONINI), A., ii, 150.
- Scölecite**, action of ammonium chloride on (CLARKE and STEIGER), A., ii, 414.
- Scopolamine** (HESSE), A., i, 50; (GADAMER), A., i, 356.
- i*-Scopolamine**. See Atroscine.
- Sea urchin**, unfertilised eggs of, artificial production of normal larvæ from (LOEB), A., ii, 555.
- Sea water**. See under Water.
- Sea-weed**. See *Ulva latissima*.
- Selenite**, dehydration of (ZUNINO), A., ii, 479.
- Selenium**, allotropic forms of (SAUNDERS), A., ii, 650.
isomorphism of, with tellurium (NORRIS and MOMMERS), A., ii, 537.
dioxide, action of sodium thiosulphate on (NORRIS and FAY), A., ii, 272.
- Selenates**, double, of the type R_2M (SeO_4) $_2$.6H $_2$ O, crystallography of (TUTTON), A., ii, 593.
- Selenotetrathionic acid**, sodium salt of (NORRIS and FAY), A., ii, 272.
- Selenium organic compounds**:—
- Selenium compounds**, cyano- (MUTHMANN and SCHRÖDER), A., i, 479.
- Selenium**, detection and separation of:—
test for, in sulphuric acid (SCHLAGDENHAUFFEN and PAGEL), A., ii, 342.
- Selenium**, separation of:—
separation of, from tellurium (CRANE), A., ii, 473; (KELLER), A., ii, 573.
- Selenoantimonites** (POUGET), A., ii, 84.
- Semicarbasinopropionic acid**, acyl derivatives of (BAILEY and ACREE), A., i, 528.
- Semicarbasones**, decomposition of (KIRPING), P., 1900, 68.
hydrolysis of (YOUNG and WITHAM), P., 1900, 73.
- Semicarbasylcamphorformenecarboxylic acids** (J. B. and A. TINGLE), A., i, 803.
- Seminase** (BOURQUELOT and HÉRISSEY), A., i, 320; ii, 35, 233.
- Senna leaves**, constituents of (TSCHIRCH and HIEPE), A., i, 681.
- Serpentine** from Silesia, nickel in (ASCHERMANN), A., ii, 86.
- Serum**, antidiphtheric, granular deposit from (MAILLARD), A., i, 266.
antihæmatic (NOLF), A., ii, 741.
antihepatic (DELEZENNE), A., ii, 675.
antileucocytic, action of, on blood (DELEZENNE), A., ii, 423, 554.
hæmolytic (BORDET), A., ii, 741.
and red corpuscles (CANTACUZÈNE), A., ii, 741.
ox-, albumin in (HOUGARDY), A., i, 709.
- Serum-globulin**, solubility of, in water (MARCUS), A., i, 127.
- Sesame oil**, constituents of (BÖMER and WINTER), A., ii, 178.
analysis of (UTZ), A., ii, 699.
Baudouin's test for (KERF), A., ii, 116.
colour tests for (BELLIER), A., ii, 117.
detection of, in butter (WEIGMANN), A., ii, 40; (SOHN), A., ii, 55; (KERF), A., ii, 116; (BREMER; SOLTSIEN), A., ii, 325; (AMTHOR), A., ii, 453.
detection of, in margarine (BÖMER and WINTER), A., ii, 178; (BREMER; SOLTSIEN), A., ii, 325; (AMTHOR), A., ii, 453.
- Sesamin**, properties of (BÖMER and WINTER), A., ii, 178.
- Sesquimethylenesparagine** (SCHIFF), A., i, 85.
- Sesquiterpene** from oil of poplar buds (FICHTER and KATZ), A., i, 108.
- Sesquiterpenes** from citronella oil (SCHIMMEL and Co.), A., i, 184.
- Sewage effluents**, estimation of dissolved oxygen in (LETTS and BLAKE), A., ii, 755.
- Sheep**. See Agricultural Chemistry.
- Shells of Mytilus and Pinna**, organic substance of the (WETZEL), A., ii, 555.

Shock, surgical, use of alkaline solutions in (HOWELL), A., ii, 558.

Silica. See **Silicon dioxide**.

Silicon, spectrum of (LOCKYER), A., ii, 181; (LUNT), A., ii, 585.

amorphous, and its chloride and sulphide, preparation of (HEMPEL and v. HAAS), A., ii, 275.

Silicon borides, SiB_3 and SiB_5 , preparation and properties of (MOISSAN and STOCK), A., ii, 539.

tetrachloride, hydrolysis of (v. KOWALEWSKY), A., ii, 731.

dioxide (silica), expansion of fused (LE CHATELIER), A., ii, 539.

permeability of molten, to hydrogen (VILLARD), A., ii, 652.

estimation of, in chrome ore (TATE), A., ii, 313.

estimation of, colorimetrically, in mineral waters (SALVADORI and PELLINI), A., ii, 367.

Silicates, constitution and classification of (BUTURANU), A., i, 285.

fused, solidification of, under high and normal pressure (OETLING), A., ii, 149.

Silicovanadiumolybdates (FRIEDHEIM and CASTENDYCK), A., ii, 483.

Silicon organic compounds :—

Silico-phenylamide, -diphenylimide, and -triphenylguanidine (REYNOLDS), T., 836; P., 1900, 135.

Silicon, estimation of :—

estimation of, in ferro-chromium (TATE), A., ii, 313.

Silver, electrolytic deposition of, from non-aqueous solutions (KAHLENBERG), A., ii, 521.

sensitiveness of, to light (WATERHOUSE), A., ii, 585.

electrochemical equivalent of (RICHARDS, COLLINS, and HEIMROD), A., ii, 256.

action of chlorine on, in the light and in the dark (v. CORDIER), A., ii, 343, 723.

reversible reaction between hydrogen chloride and (JOUNIAUX), A., ii, 139.

Silver salts, complex (HELLWIG), A., ii, 728.

action of sodium thiosulphate on (FAKTOR), A., ii, 691.

Silver halogen salts, solubility of (THIEL), A., ii, 521.

double, with ammonium thiosulphate (ROSENHEIM and STEINHÄUSER), A., ii, 653.

Silver bromide and chloride, photochemical experiments on (LUTHER), A., ii, 181.

Silver bromide, chloride and iodide, precipitated, equilibrium in (THIEL), A., ii, 521.

platosemiammine chloride (JÖRGENSEN), A., i, 542.

fluoride, electrochemical properties of (ABEGG and IMMERWAHR), A., ii, 256.

compound of, with ammonium fluoride (GRÜTZNER), A., ii, 541.

hydroxide, absorption of hydrogen by (COLSON), A., ii, 241.

nitrate, formation and transition of mixed crystals of sodium nitrate and (HISSINK), A., ii, 339.

formation and transformation of the double salts of thallium nitrate and (VAN EIJK), A., ii, 403.

peroxynitrate (SULC), A., ii, 595.

oxide, action of acetylene on (GOOCH and BALDWIN), A., i, 74.

action of, on bromoamines (KIJNER), A., i, 277, 333, 629.

dry, and alkyl iodides, alkylation by means of (LANDER, T., 736; P., 1900, 6, 90.

peroxide, action of hydrogen sulphide on (VANINO and HAUSER), A., ii, 279.

peroxysulphate (MULDER), A., ii, 724.

sulphite and thiosulphate, double salts with the alkali metals (ROSENHEIM and STEINHÄUSER), A., ii, 652.

thioantimonites, double salts with alkali metals (POUGET), A., ii, 84.

Silver organic compounds :—

peroxyacetate (MULDER), A., ii, 724.

platosemi-ethylene chloride (JÖRGENSEN), A., i, 542.

Silver, detection and estimation of :—

detection of, by dimercurous ammonium chloride (LETEUR), A., ii, 246.

estimation of, volumetrically (ANDREWS), A., ii, 760.

estimation of, by Volhard's method (ROSE), T., 232; P., 1900, 5.

estimation of, on plated copper utensils (GIRARD), A., ii, 170.

Silver bullion, assay of (ROSE), T., 232; P., 1900, 5.

Skin, absorption of iodides by the (GALLARD), A., ii, 419.

Slags, basic, valuation of (DAFERT), A., ii, 167.

estimation of phosphoric acid in (HERZFELD), A., ii, 243, 367.

Wagner's reagent for the estimation of soluble phosphoric acid in (CASALI), A., ii, 311.

See also Agricultural Chemistry.

- Slates** (READE and HOLLAND), A., ii, 150.
- Soap emulsions**, nature of (DONNAN), A., ii, 201.
- Soaps**, action of, in the body (MUNK), A., ii, 418.
 absorption of, in the large intestine (HAMBURGER), A., ii, 418.
 analysis of (SHUKOFF and NOGIN), A., ii, 326.
 analysis of the fatty matter of (SMETHAM and DODD), A., ii, 377.
 estimation of free alkali in (DIVINE), A., ii, 759.
 estimation of total and free alkali and alkali carbonate in (HENRIQUES and MAYER), A., ii, 687.
 estimation of glycerol in (JEAN), A., ii, 694.
 glycerin-, estimation of sugar in (FREYER), A., ii, 373.
 estimation of the water-softening power of (RICHARDSON and JAFFE), A., ii, 326.
- Soda**, natural, from Egypt (SCHWEINFURTH and LEWIN), A., ii, 283.
- Sodium**, electrical effects produced during the evaporation of, in air and other gases (HENDERSON), A., ii, 588.
 in the red corpuscles of the blood of animals (BOTTAZZI and CAPPELLI), A., ii, 226.
 in cartilage (v. BUNGE), A., ii, 92.
- Sodium alloys** with bismuth, with cadmium, with lead, and with mercury, composition and melting points of (KURNAKOFF), A., ii, 277.
- Sodium amalgams** (KURNAKOFF), A., ii, 277; (GUNTZ and FÉREÉ), A., ii, 540; (KEEP and BÜTTGER), A., ii, 656.
- Sodium aluminates** (ALLEN and ROGERS), A., ii, 727; (HERZ), A., ii, 728.
 antimonide, arsenide, bismuthide and stannide, preparation of (LEBEAU), A., ii, 276.
 baborate (borax), separation of boric acid from (BEYTHIEN and HEMPEL), A., ii, 318.
 carbonate, use of, in surgical shock (HOWELL), A., ii, 558.
 detection of, in milk (SÜSS), A., ii, 759.
 chloride, relationship between the composition of solutions of potassium chloride and (WILSON), A., ii, 285.
 electrolysis of (WOLF), A., ii, 382; (LORENZ and WEHRLIN), A., ii, 476.
- Sodium chloride**, electrical conductivity of solutions of (KOHLEAUSCH and MALTBY), A., ii, 61.
 dissociation and dissociation equilibrium of (JAHN), A., ii, 523, 707.
 viscosity of solutions of (HOSKING), A., ii, 336.
 poisonous character of (LOEB), A., ii, 227.
 changes in the composition of the blood after transfusion of (MAGNUS), A., ii, 665.
 influence of solutions of, injected subcutaneously, on proteid metabolism (KREUMACHER), A., ii, 670.
 poisonous properties of, towards plants (COUPIN), A., ii, 236.
 fluoride, compound of, with uranyl fluoride, and the action of hydrogen peroxide on it (LORDKIPANIDZE), A., ii, 658.
 iodide, influence of, on the circulation (BARBERA), A., ii, 291.
 nitrate, electrical conductivity of solutions of (KOHLEAUSCH and MALTBY), A., ii, 61.
 formation and transition of mixed crystals of potassium nitrate and, and of silver nitrate and (HIS-SINK), A., ii, 339.
 estimation of potassium perchlorate in (BLATTNER and BRASSEUR), A., ii, 755.
 See also Agricultural Chemistry.
- nitrite**, colour and physical properties of solutions of (BOGUSKI), A., ii, 75.
- cobalt nitrite**, preparation of (BIHLMANN), A., ii, 624.
 and salt of, with potassium (ADIE and WOOD), T., 1076; P., 1900, 17.
- dioxide**, hydrate of, thermochemistry of (DE FORCRAND), A., ii, 129.
- phosphates** (v. KNORRE), A., ii, 651.
- selenoantimonites** and complex salts with sulphur and thioantimonites (POUGET), A., ii, 84.
- selenotetrathionate** (NORRIS and FAY), A., ii, 272.
- silicate solutions** as a solvent of quartz (SPEZIA), A., ii, 595.
- sulphate**, test by freezing point determinations of the dissociation values of solutions of (ARCHIBALD), A., ii, 65.
- chromium sulphate** (PAGEL), A., ii, 349.
- hydroximidodisulphate**, gradual decomposition of (DIVERS and HAGA), T., 978; P., 1900, 147.

- Sodium hydrosulphides, sulphides and polysulphides** (BLOKAM), T., 753; P., 1899, 146.
- sulphides, action of, on aromatic nitro-compounds (BLANKSMA), A., i, 226, 482.
- sulphite, decomposition of an ice-cold solution of, by carbon dioxide (DIVERS and HAGA), T., 681.
- hydrogen sulphite, combination of, with organic compounds by an ethylene linking (LABBE), A., i, 149.
- hyposulphite (BERNTSEN and BAZLEN), A., ii, 203.
- osmisulphite and chloro-osmisulphite (ROSENHEIM), A., ii, 660.
- potassium sulphites, non-existence of two isomeric (FRAPS), A., ii, 276.
- sulphite and thiosulphate, double, with silver and copper (ROSENHEIM and STEINHÄUSER), A., ii, 652.
- thiosulphate, fusion of (KÜSTER and THIEL), A., ii, 68.
- decomposition of, by acids (v. OETTINGEN), A., ii, 400.
- crystalline hydrates of (TAYLOR), A., ii, 206.
- action of, on bismuth and iron salts (FAKTOR), A., ii, 692.
- action of, on chromium and silver salts (FAKTOR), A., ii, 691.
- action of, on lead salts (FAKTOR), A., ii, 688, 691.
- action of, on mercury salts (FAKTOR), A., ii, 627.
- titration of mercury salts by (NORTON), A., ii, 689.
- action of, on potassium antimony tartrate (FAKTOR), A., ii, 598.
- action of, on selenium dioxide, and on tellurium dioxide (NORRIS and FAY), A., ii, 272.
- detection of (HUYSE), A., ii, 245.
- tungstate, solubility of, in water, and the density and refractive index of its solution (PAWLEWSKI), A., ii, 400.
- Sodium, detection of, in presence of potassium** (SCHOORL), A., ii, 625.
- Soil - analyses** (v. FEILITZEN), A., ii, 504.
- Soils, mechanical analysis of** (SCARLATA), A., ii, 368.
- estimation of combined carbon dioxide in (SCHÜTTE), A., ii, 48.
- estimation of combined carbon dioxide in, by Stutzer and Hartleb's method (WOY), A., ii, 170.
- rapid estimation of clay in (POQUILLON), A., ii, 316.
- estimation of humus in (ASCHMAN and FABER), A., ii, 60.
- Soils, estimation of humus in, errors in the** (EMERY), A., ii, 516.
- estimation of available phosphoric acid in (PAGNOUL), A., ii, 167.
- estimation of phosphoric acid available as plant food in (PLOT), A., ii, 510.
- estimation of phosphoric acid and potash in, by the humic acid method (HOFFMEISTER), A., ii, 244.
- estimation of potash in (ADIE and WOOD), T., 1079; P., 1900, 18; (HOFFMEISTER), A., ii, 244.
- See also Agricultural Chemistry.
- Solanaceæ, alkaloids of the** (HESSE), A., i, 50; (GADAMER), A., i, 356.
- Solanine, physiological functions of** (ALBO), A., ii, 234.
- Solanthic acid** (BRÄUTIGAM), A., i, 177.
- Solubility.** See under Solution.
- Solution, theory of** (WILDERMANN), A., ii, 262.
- behaviour of hydrated salts in (BANCROFT), A., ii, 195.
- Solubility, changes of, by the addition salts** (ROTHMUND), A., ii, 467.
- of mixtures of salts having one common ion (TOUREN), A., ii, 396, 530, 646.
- relation between heat of solution and, of electrolytes (VAN LAAR), A., ii, 708.
- of hydrated mixed crystals (STORTENBEKER), A., ii, 530.
- of quartz in sodium silicate solutions (SPEZIA), A., ii, 595.
- of argon and helium in water (ESTREICHER), A., ii, 205.
- of carbon dioxide in alcohol and water (BOHR), A., ii, 267.
- of hydrogen and nitrogen in aqueous solutions of dissociating substances (BRAUN), A., ii, 529.
- of nitrogen and oxygen in various liquids at low temperatures (CLAUDE), A., ii, 649.
- of the alkaline earth carbonates in water containing carbon dioxide (BODLÄNDER), A., ii, 715.
- of barium, potassium and sodium chlorides and of ammonium sulphate at the boiling point (BUCHANAN), A., ii, 711.
- of salts of calcium, iron and copper in sucrose solutions (STOLLE), A., i, 333.
- of calcium carbonate in sea water (COHEN and RAKEN), A., ii, 725.
- of lime (in three forms) in sugar solutions (WEISBERG), A., i, 623.
- of cupric chloride in organic liquids (OECHSNER DE CONINCK), A., ii, 542.

- Solubility** of tricalcium phosphate in natural waters in presence of carbonic acid (SCHLÖSSING), A., ii, 541, 618.
 of potassium carbonate solution in aqueous ammonia, and *vice versa* (NEWTH), T., 775; P., 1900, 87.
 of mixed potassium nitrite and nitrate (DIVERS), P., 1900, 40.
 of silver halogen salts (THIEL), A., ii, 521.
 of sodium tungstate in water (PAWLEWSKI), A., ii, 400.
 of zinc hydroxide (HERZ), A., ii, 338.
 of hydrates of zinc sulphate (COHEN), A., ii, 184.
 of anhydrides of organic acids in water (VAN DE STADT), A., i, 200.
 reciprocal, of liquids (BRUNI), A., ii, 196.
 of benzophenone (DERRIEN), A., i, 299.
 of ethyl acetate in aqueous salt solutions (EULER), A., ii, 196.
 of osazones (NEUBERG), A., i, 410.
 of trialkyl phosphates and their lead and barium salts (CAVALIER and PROST), A., i, 580.
 of uric acid in nucleic and thymic acids (KOSSLER and GOTO), A., ii, 421; (GOTO), A., ii, 740.
 of silver *d*-valerate (TAVERNE), A., i, 473.
- Solubility coefficients** of water and aniline, and water and *n*-amyl alcohol (AIGNAN and DUGAS), A., ii, 68.
- Solutions**, electrolytic decomposition point of aqueous (GOCKEL), A., ii, 332.
 thermokinetic properties of (NATANSON), A., ii, 191.
 diminution of vapour pressure, and increase in boiling point of dilute (SMITS), A., ii, 708.
 errors in determining the freezing point in dilute (WILDERMANN), A., ii, 131.
 dissociation in dilute, at 0° (WHEATHAM), A., ii, 390.
 composition of the surface layers of aqueous (v. ZAWIDZKI), A., ii, 713.
 colloidal. See Colloidal.
 concentrated, osmotic pressure of (EWAN), A., ii, 195.
 inorganic, partially miscible (NEWTH), T., 775; P., 1900, 87.
 isohydric, dissociation in (BANCROFT), A., ii, 529.
 saline, boiling temperatures and concentrations of (BUCHANAN), A., ii, 710.
 hydrolysis of (LEV), A., ii, 67, 731; (BRUNER), A., ii, 268.
- Solutions**, saline, causes of the changes of colour of (KONOWALOFF), A., ii, 266.
 behaviour of, towards ammonia (KONOWALOFF), A., ii, 265.
 action of magnesium on (TOMMASI), A., ii, 16; (MOURAOUR), A., ii, 206.
 saturated, electrolytic conductivity of (DAWSON and WILLIAMS), A., ii, 383.
 solid, and isomorphous mixtures (BRUNI), A., ii, 196.
 of saturated and non-saturated open-chain compounds (BRUNI and GORNI), A., ii, 714.
- Solution pressure**, theory of (MILNER), A., ii, 385.
 electrolytic, theory of (LEHFELDT), A., ii, 62; (KRÜGER; NERNST), A., ii, 706.
- Solution tension** of zinc in ethyl alcohol (JONES and SMITH), A., ii, 467.
- Solvent**, a new inorganic dissociative (WALDEN), A., ii, 10.
 formic acid as a (BRUNI and BERTI), A., ii, 591, 592.
 nitrogen peroxide as a (BRUNI and BERTI), A., ii, 591.
 influence of the, on the constitution of ethyl acetoacetate and similar substances (WISLICENUS), A., i, 9.
 influence of the, on the cryoscopic behaviour of phenols (AUWERS), A., ii, 66.
 cryoscopic behaviour of substances with constitutions similar to that of the (GARELLI and CALZOLARI), A., ii, 65.
 See also Cryoscopy.
- Soot**, composition of, from mineral coal (WARTH), A., ii, 723.
- Sorbic acid**, synthesis of (DOEBNER), A., i, 536.
- Sorbinose** (*sorbose*), polarisation and reducing power of (SMITH and TOLLENS), A., i, 378.
- d*-**Sorbinose** (DE BRUYN and ALBERDA VAN EKENSTEIN), A., i, 208.
- l*-**Sorbinose** (*ψ-lagatose*) (DE BRUYN and ALBERDA VAN EKENSTEIN), A., i, 208, 332.
- i*-**Sorbinose**, nature of (ADRIANI), A., i, 628.
- d*-**Sorbitol**, compounds of, with benzaldehyde and *p*-nitrobenzaldehyde (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.
- d*- and *l*-**Sorbitols**, benzyldene and methylene derivatives of (DE BRUYN and ALBERDA VAN EKENSTEIN), A., i, 332.

Specific gravity. See Density.
 heat. See Thermochemistry.
 rotation. See Photochemistry.
Spectrometer scale reader, improved (PERKIN), T., 291.
Spectrum. See Photochemistry.
Spermine, Poehl's, physiological action of (DIXON), A., ii, 676.
Sphagnol (CZAPPEK), A., i, 556.
Sphene from Japan (JIMBŌ), A., ii, 88.
 from Moravia (KOVÁČ), A., ii, 148.
Sphingosine and Sphingomyelin (THUDICHUM), A., i, 320.
Spiræin from Spiræas (BEYERINCK), A., i, 108.
Spirits, estimation of fusel oil in (ADAM), A., ii, 53; (BECKMANN and BRÜGGMANN), A., ii, 175.
Sporidiophyllite from Greenland (FLINK), A., ii, 410.
Spruce fir. See Agricultural Chemistry.
Stannic and Stannous. See under Tin.
Starch, natural and artificial, physical properties of (RODEWALD and KATTEIN), A., i, 477.
 heat developed by, by the absorption of water (RODEWALD and KATTEIN; RODEWALD), A., i, 477.
 preparation of solutions of, and separation of starch granules (RODEWALD and KATTEIN), A., i, 79.
 action of amylase on (POTTEVIN), A., i, 80.
 digestion of, in the stomach of Carnivora (FRIEDENTHAL), A., ii, 224.
 potato-, constitution, and hydrolysis of (SYNIEWSKI), A., i, 78.
 wheat-, specific heats of (RODEWALD and KATTEIN), A., i, 477.
 estimation of (CRISPO), A., ii, 176.
 estimation of, in yeast (BRUYLANTS and DRUYTS), A., ii, 113.
Starch-meal. See Agricultural Chemistry.
Stars, spectra of, origin of certain unknown lines in the (LUNT), A., ii, 585.
Stearic acid, formation of, from oleic acid (FREUNDLICH and ROSAUER), A., i, 581.
 mono- and di-bromo- (KASANSKY), A., i, 426.
Steel. See under Iron.
Steenstrupine from Greenland (BOEGGILD), A., ii, 413.
Stereochemical behaviour of the nitro-group (WEDEKIND), A., i, 216.
 observations on the reaction between picric chloride and aromatic amines (WEDEKIND), A., i, 216.

Stereoisomerides and racemic compounds (COOPER), A., ii, 269.
Stilbene (*s-diphenylethylene*) and its derivatives, preparation of; (v. WALTHER and WETZLICH), A., i, 438.
 refraction of (CHILESOTTI), A., i, 339.
Stokesite from Cornwall (HUTCHINSON), A., ii, 89, 603.
Stomach, chemical processes in the (SCHUYTEN), A., ii, 509.
 formation of hydrochloric acid in the (WESENER), A., ii, 92.
 See also Gastric juice.
Stomach contents, relationship between the nitrogen and chlorides of the (WINTER and FALLOISE), A., ii, 554.
Storax, examination of (DIETEBICH; EVERES), A., ii, 118.
Streptococcus hornensis (BOEKHOUT), A., ii, 742.
Streptothrix chromogena, biology of (BEYERINCK), A., ii, 425.
Strontium salts, toxic action of, in plant culture (COUPIN), A., ii, 363; (SUZUKI), A., ii, 561.
Strontium amalgam (KERP and BÖTTGER), A., ii, 656.
Strontium aluminates (ALLEN and ROGERS), A., ii, 727.
 chromate, action of ammonium chloride on (DUMESNIL), A., ii, 625.
 dioxide, hydrated and anhydrous, heat of formation of (DE FORCRAND), A., ii, 344.
 phosphide, crystallised (JABOIN), A., ii, 76.
 sulphide, phosphorescent, preparation of (MOURELO), A., ii, 141.
Strontium, detection and separation of:—
 detection of barium, calcium and (DUMESNIL), A., ii, 625.
 separation of, from barium and calcium (KÜSTER), A., ii, 108.
Strophanthic acid (FEIST), A., i, 556.
Strophanthidin and its isomeride, strophanthidolactone (FEIST), A., i, 555.
Strophanthin and ψ -Strophanthin, and their hydrolysis (FEIST), A., i, 555.
Strychnine, action of chloroform, iodoform, and methylene iodide on (TROWBRIDGE), A., i, 187.
 additive derivatives of (TROWBRIDGE), A., i, 517.
 salts, behaviour of, to chloroform (HILL), A., ii, 455.
 estimation of (FARR and WRIGHT), A., ii, 778.
Strychnine, tetrachloro- and its oxime, and hexachloro- (MINUNNI and ORTOLEVA), A., i, 309.

- Styrene** (*cinnamene*; *phenylethylene*), influence of light on the transformation of, into metastyrene (LEMOINE), A., i, 91.
 action of iodine and mercuric oxide on (BOUGAULT), A., i, 641.
- C-Styrenylhydroxytriazole** and its acetyl derivatives (YOUNG and WITHAM), T., 294; P., 1900, 5.
- Styrolene** diformate (BEHAL), A., i, 581.
- Styrylcarbamie acid**, methyl and ethyl esters (THIELE and PICKARD), A., i, 30.
- Styryltrichloromethylcarbinol**, synthesis of, its acetyl derivative, and the action of aqueous potassium hydroxide on (DRBOGLAFF), A., i, 490.
- Suberone**. See *cyclo*Heptanone.
- Sublimation**, apparatus for (RIIBER), A., ii, 468.
- Submaxillary gland**. See Gland.
- Substance**, m. p. 132-133°, from acetone and persulphuric acid (v. BAEYER and VILLIGER), A., i, 133.
 m. p. 120°, from an alcoholic solution of acetophenone (OECHSNER DE CONINCK and DERRIEN), A., i, 508.
 m. p. 180° and 182°, from alcoholic solutions of benzophenone (OECHSNER DE CONINCK and DERRIEN), A., i, 502.
- $N_2H_4S_2O_8$, and its salts, from the decomposition of ammonium amidosulphite (DIVERS), P., 1900, 104.
- $C_6H_5O_4Hg_4NO_3$, from the action of methylalcoholic potash and mercuric oxide on potato-starch (HOFMANN), A., i, 384.
- $C_6H_5O_4N_2$, from the electrolytic oxidation of acetoxime (SCHMIDT), A., i, 332.
- $C_6H_5O_4Hg_4NO_3$, from the action of methylalcoholic potash and mercuric oxide on sucrose (HOFMANN), A., i, 384.
- $C_6H_{10}O_4S_2$, from trimethylenedisulphone and formaldehyde (KÖRTZ), A., i, 370.
- $C_6H_5O_4N_4$, from the action of nitric acid on acetylene (BASCHIERI), A., i, 534.
- $C_6H_5OCl_4$, from the action of chlorine monoxide on benzene (SCHOLL and NÖRR), A., i, 337.
- $C_6H_5O_2$, from the hydrolysis of acetylcarbonyl acetate (PERATONER and LEONARDI), A., i, 551.
- $C_6H_5O_4N_6$, isomeric, from acetyl-methylnitric acid, and their derivatives (STEFFENS), A., i, 74.
- Substances**, $C_6H_5O_4N_2$, from the oxidation of α -mesityloxime (HARRIES), A., i, 504.
 $C_6H_5O_4N_2$, from trinitroanhydrodiacetonecarbamide (TRAUBE and LORENZ), A., i, 116.
 C_6H_5Br , from the action of bromine on camphonic acid (LAPWORTH and CHAPMAN), T., 466; P., 1900, 57.
 $C_6H_5O_2N$, from chloroform, alcoholic potash and α -benzylhydroxylamine (BIDDLE), A., i, 137.
 $C_6H_{11}I$, from iodoform and acetone (NEF), A., i, 2.
 $C_8H_{11}O_3N_7$, from chloroamino-4-methylpyrimidine and carbamide (GABRIEL and COLMAN), A., i, 56.
 $C_8H_{12}O_3$, from the action of hydriodic acid on acetylcedron (ČEČELSKY), A., i, 225.
 $C_8H_{14}ON_2$, from the oxidation of 4:4-dimethyl-5-isopropylpyrazoline (FRANKE), A., i, 212.
 $C_8H_{14}O_3N_2$, from the action of nitrous acid on β -hexahydro-*p*-benzylamine-carboxylic acid (EINHORN and LADISCH), A., i, 228.
 $C_9H_{10}OCl_2$, from the action of chloroform and alkali on 1:3:4-xylenol (AUWERS), A., i, 160.
 $C_9H_{15}O_3N_2Cl$, by the action of hydroxylamine and hydrogen chloride on hydroxymethylenetropinone (WILLSTÄTTER and IGLAUER), A., i, 244.
 $C_{10}H_8O_3N_8$, from 4-methylpyrimidine and fuming nitric acid (GABRIEL and COLMAN), A., i, 56.
 $C_{10}H_8O_3N_2$, from the oxidation of benzyldieneacetoxime (HARRIES), A., i, 504.
 $C_{10}H_{14}O_6N_2$, from α -dibromocamphor and nitric acid (LAPWORTH and CHAPMAN), T., 309; P., 1900, 4.
 $C_{10}H_{12}Br$, from tribromofenchane, zinc dust, and acetic acid (CZERNY), A., i, 676.
 $C_{10}H_{16}O_4$, from camphor, potassium persulphate and sulphuric acid (v. BAEYER and VILLIGER), A., i, 133.
 $C_{10}H_{18}O_4$ and $C_{10}H_{16}O_4$, from the condensation of glyoxal and isobutaldehyde (v. HORNOSTEL and SIEBEN), A., i, 206.
 $C_{10}H_{17}O_3N$, $C_{10}H_{15}ON_3$, and $C_{10}H_{15}O_2N_3$, from methyl propyl ketone, isomethyl nitrite, and hydrogen chloride (KISSER), A., i, 621.
 $C_{10}H_{23}O_2$, from isomethyl nitrite, isomethyl alcohol, and hydrogen chloride, and its oxidation products (KISSER), A., i, 620.

- Substance, $C_{10}H_{22}O_3$** , from carvomethyl bromide or chloride and silver oxide (KONDAKOFF and LUTSCHININ), A., i, 106.
- $C_{10}H_{22}O_3$, and $C_{12}H_{22}O_4$, from isobutyl nitrite, alcohol, and hydrogen chloride (KISSER), A., i, 621.
- $C_{11}H_{16}O_2$, obtained by the distillation of leaf fenchocarboxylate (WALLACH, NEUMANN, and v. WESTPHALEN), A., i, 241.
- $C_{12}H_{18}O_2I$, from iodophenylacetylene, silver acetate and glacial acetic acid (NEF), A., i, 22.
- $C_{12}H_{11}O_3$, from the empyreumatic oil of juniper (CATHELNEAU and HAUSER), A., i, 510.
- $C_{12}H_{13}O_4N_2S_3$, from bromine, carbon disulphide, and ethyl sodiocyanoacetate (WENZEL), A., i, 536.
- $C_{13}H_9O_3Br$, from the action of alcoholic potash on ethyl bromonaphthaquinonesacetate (LIEBERMANN), A., i, 311.
- $C_{13}H_{18}O_6$ (?), from the reduction of ethyl dimethylpyrinedicarboxylate (OLIVERI-TORTORICI), A., i, 552.
- $C_{14}H_{12}N_4$, from the decomposition of "cyanobenzidine" (MEVES), A., i, 484.
- $C_{14}H_{14}O_5N_2$, and $C_{14}H_{16}O_5N_2$, from the oxidation of hematoporphyrin (KÜSTER and KÖLLE), A., i, 69.
- $C_{14}H_{16}O_6N_3$, from semicarbazide and ethyl dimethylpyrinedicarboxylate (OLIVERI-TORTORICI), A., i, 552.
- $C_{14}H_{26}N_4S_3$, from formaldehyde, piperidine and dithio-oxamide (WALLACH), A., i, 211.
- $C_{15}H_{14}O_2N_2$, from thymoquinone and benzoylphenylhydrazine (MCIPHERSON), A., i, 124.
- $C_{16}H_{15}ON_2$, from α -benzaminocinnamide (ERLENMEYER), A., i, 549.
- $C_{16}H_{12}O_4$, from *Digitalis lutea* (ADRIAN and TRILLAT), A., i, 185.
- $C_{16}H_{22}O_6S_3$, from bromine, carbon disulphide, and ethyl sodiomalonate (WENZEL), A., i, 536.
- $C_{16}H_{20}O_4$, from the reduction of *p*-methylolbenzoic acid with sodium and amyl alcohol (EINHORN and LADISCH), A., i, 228.
- $C_{16}H_{20}N_4S_3$, from acetaldehyde, piperidine and dithio-oxamide (WALLACH), A., i, 211.
- $C_{17}H_{16}O$, from benzophenone (OECHSNER DE CONINCK and DERRIER), A., i, 502.
- $C_{17}H_{16}O_8$, from resorcinol and formaldehyde in presence of dilute mineral acids (GOLDSCHMIDT), A., i, 436.
- Substance, $C_{17}H_{20}O_5$** , from the action of alcoholic potash on acid, $C_{19}H_{18}O_9$ (GILBODY, PERKIN, and YATES), P., 1900, 107.
- $C_{18}H_{16}O_5N_2$, from *p*-aminobenzoic acid and ethyl acetoacetate in presence of pyridine (TROEGER), A., i, 227.
- $C_{18}H_{20}O_2N_2$, from *o*-phenylenediamine and camphoroxalic acid (J. B. and A. TINGLE), A., i, 302.
- $C_{18}H_{22}N_2S_2$, from formaldehyde, methylaniline and dithio-oxamide (WALLACH), A., i, 211.
- $C_{19}H_{18}O_4$, from the action of phenylhydrazine on trimethylbrazilone (GILBODY, PERKIN, and YATES), P., 1900, 105.
- $C_{19}H_{18}O_6N_2$, from the action of hydroxylamine hydrochloride on dipiperonalacetone (MINUNNI and CARTASATTA), A., i, 237.
- $C_{19}H_{18}O_2N$, and $C_{20}H_{20}O_3N$, from the condensation of benzyl cyanide and ethyl cinnamate (ERLENMEYER), A., i, 493.
- $C_{19}H_{16}O_7N$, from the oxime of *d*-usuic anhydride and sodium methoxide (WIDMAN), A., i, 235.
- $C_{19}H_{22}O_8$, from isolaricresinol (BAMBERGER and LANDSIEDL), A., i, 48.
- $C_{19}H_{30}O_5N_{11}$, by the action of nitrous acid on hexethylidenetetramine (KUDERNATSCHE), A., i, 337.
- $C_{20}H_{18}ON_3$, from the action of carbonyl chloride on anilindiphenylguanidine (SCHALL), A., i, 464.
- $C_{20}H_{24}N_2S_3$, from formaldehyde, methylaniline, and dimethyldithio-oxamide (WALLACH), A., i, 211.
- $C_{20}H_{26}N_2S_3$, from formaldehyde, ethylaniline, and dithio-oxamide (WALLACH), A., i, 211.
- $C_{20}H_{26}ON_3$, from the oxidation of methanementhylhydrazone (KJERNER), A., i, 278.
- $C_{21}H_{16}N_4$, from benzoic chloride and "cyananiline" (MEVES), A., i, 483.
- $C_{22}H_4O_8$, and $C_{22}H_{10}O_8$, from 1:4-dihydroxynaphthalene (RUSSIO), A., i, 601.
- $C_{22}H_{16}O_4$, from the oxidation of methoxynaphthol (RUSSIO), A., i, 602.
- $C_{22}H_{16}O$, from the hydrogen chloride additive product of benzylidenedibenzyl ketone and potassium hydroxide (GOLDSCHMIDT and KNÖPFER), A., i, 35.
- $C_{22}H_{18}O_2N_2$, from 3:5-diphenylisoxazoleoxime and phenylcarbimide (WISLICHENUS), A., i, 38.

- Substance**, $C_{22}H_{19}O_3N_3$, from ammonia, benzaldehyde, ethyl methylcyanoacetate and ethyl ethylcyanoacetate (GUARESCHI), A., i, 52.
- $C_{22}H_{20}N_4S_2$, from formaldehyde, ethyl-aniline, and dimethyldithio-oxamide (WALLACH), A., i, 211.
- $C_{22}H_{24}O_3N_{10}$, from a mixture of glycine and glycerol (BALBIANO and TRACIATTI), A., i, 632.
- $C_{22}H_{24}N_4S_2$, from valeraldehyde, piperidine and dithio-oxamide (WALLACH), A., i, 211.
- $C_{23}H_{14}O_2N_2$, from acetylmorphenol, chromic acid and *o*-tolylenediamine (VONGERICHTEN), A., i, 248.
- $C_{23}H_{19}ON$ from the action of formaldehyde on ethyl- β -naphthylamine hydrochloride in alcoholic solution (MORGAN), T., 819; P., 1900, 131.
- $C_{24}H_{24}N_4S_2$, from formaldehyde, methyl-aniline, and diethyldithio-oxamide (WALLACH), A., i, 211.
- $C_{24}H_{24}N_4S_2$, from benzaldehyde, diethylamine, and dithio-oxamide (WALLACH), A., i, 211.
- $C_{25}H_{24}N_4S_2$, from benzaldehyde, piperidine and dithio-oxamide (WALLACH), A., i, 211.
- $C_{26}H_{26}O$, from butylxylglyoxylic acid (BAUR-THURGAU and BISCHLER), A., i, 178.
- $C_{26}H_{28}O_6$, from the action of alkalis on strophanthidin (FEIST), A., i, 556.
- $C_{29}H_{20}O_9$, from *Pachyrhizus angulatus* (VAN SILLEVOLDT), A., i, 109.
- $C_{29}H_{26}O_3$, from dibenzyl ketone and benzaldehyde (GOLDSCHMIEDT and KNÖPPER), A., i, 36.
- $C_{30}H_{20}O_5$, $C_{48}H_{26}O_6$, $C_{60}H_{42}O_9$, $C_{60}H_{50}O_{13}$, from *p*-toluoyl-*o*-benzoic acid (LIMPRICHT and WIEGAND), A., i, 498.
- $C_{30}H_{24}ON_2$, by the action of potassium cyanide on benzyl cyanide and benzoin (SMITH), A., i, 39.
- $C_{30}H_{28}N_4S_2$, from benzaldehyde, methyl-aniline, and dithio-oxamide (WALLACH), A., i, 211.
- $C_{32}H_{31}O_2NCl_2$ from chlorodibenzyl methyl ketone (GOLDSCHMIEDT and KNÖPPER), A., i, 35.
- $C_{32}H_{34}N_4S_2$, from formaldehyde, dibenzylamine, and dithio-oxamide (WALLACH), A., i, 211.
- $C_{32}H_{36}O_2N_4$, obtained in the preparation of hematoporphyrin from hemin (KÜSTER and KÖLLE), A., i, 69.
- $C_{34}H_{30}O_2N_2$, from tolylbutanonic acid and phenylcarbimide (KLOBB), A., i, 405.
- Substance**, $C_{36}H_{28}N_2S_2$, from benzaldehyde, diamylamine, and dithio-oxamide (WALLACH), A., i, 211.
- $C_{44}H_{40}O_2N_2$, and $C_{50}H_{40}O_{11}N_4$, from benzylidene- β -naphthylamine and ethyl cetipate (THOMAS-MAMERT and WEIL), A., i, 427.
- $C_{45}H_{32}O_2N_2$, from the action of benzaldehyde on ethyl- β -naphthylamine (MORGAN), T., 1210; P., 1900, 171.
- Substances**, condition of, insoluble in water, formed in gelatin (DE BRUYN), A., ii, 136, 717.
- Substitution** in phenols, inhibiting effect of etherification on (ARMSTRONG and LEWIS), P., 1900, 157.
- Succinic acid** (*ethanedicarboxylic acid*), electrolytic oxidation of (CLARKE and SMITH), A., i, 77.
- estimation of, in fermented liquids (LABORDE and MOREAU), A., ii, 114.
- ethyl ester, condensation of, with cyclic ketones (STOBBE and FISCHER), A., i, 179.
- Succinic acid**, dicyano-, ethyl ester (THORPE and YOUNG), T., 937; P., 1900, 115.
- isoSuccinic acid**. See Methylmalonic acid.
- Succinic acids**, alkyl substituted, preparation and dissociation constants of (BONE and SPRANKLING), T., 654, 1298; P., 1900, 71, 184.
- and their amic acids and imides, melting points of (AUWERS, MAYEN, and SCHLEICHER), A., i, 84.
- Succinimide**, crystalline compounds of, with phenols (VAN BREUKELEVEEN), A., i, 343.
- Succinimides**, reduction of, to pyrrolidones (TAFEL and STERN), A., i, 557.
- Succinimino-ethers**, rearrangement of (WHEELER and BARNES), A., i, 294.
- Succinylsuccinic acid**, ethyl ester, hydrogenisation of (STOLLÉ), A., i, 234.
- Succitoyl ketone** (*ditolyl ethylene diketone*) (LIMPRICHT), A., i, 600.
- Sucrose** (*saccharose, cane sugar*), formation of, from dextrose in the cell (GRÜSS), A., ii, 361.
- distribution of, in plants (ANDERSEN), A., ii, 561.
- electrolysis of solutions of (ULSCH), A., i, 15.
- variation of the specific rotation of, with the temperature (SCHÖNROCK), A., i, 378.
- influence of pressure on the rotation of solutions of (SIERTSEMA), A., ii, 329.
- cryoscopic researches on (BATELLI and STEFANINI), A., ii, 709.

- Sucrose** (*saccharose, cane sugar*), viscosity of solutions of (HOSKING), A., ii, 336.
- stability of solutions of (OECHSNER DE CONINCK), A., i, 378.
- oxidation of, by hydrogen peroxide (MORRELL and CROFTS), T., 1220; P., 1900, 171.
- inverting power of citric, oxalic and tartaric acid on (GILLOT), A., i, 208.
- solubility of salts of calcium, iron, and copper in solutions of (STOLLE), A., i, 333.
- detection of, in lactose (LANDIN), A., ii, 514.
- detection of, in margarine (MECKE), A., ii, 319.
- estimation of, in beet (KOVÁK), A., ii, 694.
- estimation of, in condensed milk (GRÜNHUT and RIEBER), A., ii, 249.
- estimation of, in glycerin-soaps (FREYER), A., ii, 373.
- Sugar from curangin** (BOORSMA) A., i, 243.
- as food (STROHMER), A., ii, 490.
- formation of, in diabetes (ROSENQVIST), A., ii, 155.
- as an aid to the growth of plants (GOLDING), A., ii, 617.
- Sugar, invert**, from Finnish mossberry (STOLLE), A., ii, 614.
- estimation of, in presence of sucrose (JESSEN-HANSEN), A., ii, 113.
- Sugar-cane**. See Agricultural Chemistry.
- "Sugar-colours,"** colouring matters contained in, and their detection (SCHWEITZER), A., i, 277.
- Sugars** of some glucosides (VOTOČEK), A., i, 355.
- obtained by the hydrolysis of strophanthin and ψ -strophanthin (FEIST), A., i, 540, 555.
- in the liver (SEEGEN), A., ii, 29.
- relation between the diuretic coefficients, osmotic pressures, and molecular weights of (HEDON and ARROUS), A., ii, 94.
- effect of, on the velocity of hydrolysis of acids (COHEN), A., ii, 716.
- inversion of, by acids, influence of normal salts on (ARRHENIUS), A., ii, 201.
- cause of the diminution of the rate of inversion of raw (STOLLE), A., i, 277.
- determination of the inverting power of raw (JESSER), A., i, 276.
- absorption of, in the intestine (HEDON), A., ii, 223.
- source of error in the detection of, in urine, by means of Fehling's solution (EURY), A., ii, 249.
- Sugars**, detection of, in urine by phenylhydrazine (KOWARSKY), A., ii, 54.
- simplification of the phenylhydrazine test for, in urine (NEUMANN), A., ii, 248.
- effect of glycuronic acid on the phenylhydrazine test for, in urine (MAYER), A., ii, 320.
- estimation of, gravimetrically (CHAPPELLE), A., ii, 112, 629.
- estimation of, in fatty substances (POSSETTO), A., ii, 176.
- estimation of, in peat-meal molasses (WOY), A., ii, 682.
- estimation of, in diabetic urine (PATEIN and DUFAY), A., ii, 176; (TROGER and MEINE), A., ii, 635.
- estimation of, in urine (NEUBERG), A., i, 410; (PELLET), A., ii, 113.
- estimation of, polarimetrically, in wine (ROCQUES), A., ii, 695.
- reducing, estimation of, polarimetrically, in wines and lees (PELLET), A., ii, 113.
- separation and purification of (RUFF and OLLENDORFF), A., i, 77.
- Sulphatosised salts**, Fremy's (DIVERS and HAGA), T., 440; P., 1900, 55.
- Sulphine derivatives**, attempts to resolve (STRÖMHOLM), A., i, 327.
- p*-**Sulphobenzene-sodium phenylamine-sulphonic acid**, sodium salt (GNEHM and WERDENBERG), A., i, 94.
- p*-**Sulphocinnamic acid**, reduction of (MOORE), A., i, 550.
- Sulphohalite**, composition of (PENFIELD), A., ii, 550.
- Sulphonal** (*diethylsulphonedimethylmethane*; *isopropylidenediethylsulphone*), detection and isolation of (VITALI), A., ii, 774.
- amino-, and its derivatives and homologues (POSNER and FAHRENHORST), A., i, 16.
- Sulphonamides** of amines, behaviour of, to alkalis (SOLONINA), A., i, 147; (MARCKWALD), A., i, 149.
- 4-Sulpho-1:2-naphthaquinoxalinediacetic acid** and its ethyl ester (THOMAS-MAMERT and WEIL), A., i, 460.
- Sulphonaphthylstearic acid** (TWITCHELL), A., i, 296.
- Sulphonation** and methylation, simultaneous, of colouring matters (PRUD'HOMME), A., i, 455.
- Sulphones**. See:—
- Acetonediamyldisulphone.
 - Acetonediphenyldisulphone.
 - Benzenesulphocamphenamide.
 - Benzenesulphonamides.
 - Benzenesulphon-o-anisidine.

Sulphones. See :—

- Benzenesulphonemethyl-*o*-anisidine.
- Benzoylamino-sulphonal.
- β -Benzylsulphonallylphthalamic acid.
- Bis- β -diamyldisulphonepropylthiocarbamide.
- Bis- β -diethyldisulphonepropylthiocarbamide.
- Diamyldisulphoneacetonephthalamic acid..
- β -Diamyldisulphonepropylcarbamide.
- β -Diamyldisulphonepropylthiocarbamide.
- β -Diethyldisulphoneglutaric acid.
- α -Diethyldisulphonepropionic acid.
- β -Diethyldisulphonepropylcarbamide.
- β -Diethyldisulphonepropylthiocarbamide.
- γ -Diethyldisulphonevaleric acid.
- Diethylethylidenedisulphone.
- Diethylketonediethyldisulphone.
- Di-2:6-lutidyl-4-sulphone.
- Dimethylaminophenyl-methyl- and -ethyl-sulphones.
- Disulphones.
- Di-*p*-toluenesulphone-methylpiperazide and -propylamine.
- β -Ethylsulphoneglutaconic acid.
- 2:6-Lutidyl-4-methylsulphone.
- Methyl- α -chloroethylketonediethylsulphone.
- Naphthylthiosulphonacetooacetic acids.
- Phenyl- β -diamyldisulphonepropylthiocarbamide.
- Phenyl- β -diethyldisulphonepropylthiocarbamide.
- Phenylsulphonacetic acid.
- Phenylsulphonpropionic acid.
- Phenylthiosulphonacetooacetic acid.
- Phthalyliminoacetonedimethyl-, -benzyl-, and -phenyl-disulphones.
- Pyridyl-2-methylsulphone.
- Sulphonal.
- Tetramethyldiaminobenzophenone-sulphone.
- Tetramethyldiaminodiphenylmethane-sulphone.
- Tetramethylenedisulphone.
- Tetrasulphones.
- Tetronal.
- p*-Tolylthiosulphonacetooacetic acid.
- Trimethylenedisulphone.
- Trional.
- Sulphonic acids**, preparation of, by means of disulphides (BLANKSMA), A., i, 226, 482.
- Sulphonic group**, removal of, by reduction (MOORE), A., i, 550.
- Sulphophenylstearic acid** (*benzenestearosulphonic acid*) (TWITCHELL), A., i, 298.
- Sulphosalicylic acid**, esters of (COHN), A., i, 548.

- Sulphur**, amount of, in plants and soils (BOGDANOFF), A., ii, 160.
- molecular weight of (BLEIER and KOHN), A., ii, 203, 721; (ARONSTEIN and MEIHZUIZEN), A., ii, 341.
- vapour density of (BLEIER and KOHN), A., ii, 203, 721; (SCHALL), A., ii, 271.
- viscosity of, at temperatures above the point of maximum viscosity (MALUS), A., ii, 536.
- stereochemistry of (SMILES), T., 160, 1174; P., 1899, 240; 1900, 168; (POPE and PRACHEY), T., 1072; P., 1900, 12.
- excretion of, after extirpation of the liver (LANG), A., ii, 556.
- excretion of, by infants (FREUND), A., ii, 226.
- loosely combined, in urine (PETRY), A., ii, 675.
- Sulphur compounds** in Canadian petroleum (MAHERY), A., i, 533.
- chloride, molecular weight of, in various solvents (ODDO and SERRA), A., ii, 75.
- action of arsenious and antimonous oxides, and of bismuth trioxide on (ODDO and SERRA), A., ii, 74.
- action of, on tungsten trioxide (SMITH and FLECK), A., ii, 81.
- Sulphuryl dichloride**, molecular weight of, in benzene (ODDO and SERRA), A., ii, 75.
- Thionyl chloride**, molecular weight of, in various solvents (ODDO and SERRA), A., ii, 75.
- action of, on dimethylaniline and on diethylaniline (MICHAELIS and SCHINDLER), A., i, 215.
- Sulphur perfluoride**, SF₆ (MOISSAN and LEBEAU), A., ii, 341, 342.
- Thionyl fluoride**, preparation, properties and analysis of (MOISSAN and LEBEAU), A., ii, 472.
- Sulphur hydride**. See Hydrogen sulphide.
- Sulphur dioxide** as a dissociative solvent (WALDEN), A., ii, 10.
- combination of, with oxygen (RUSSELL and SMITH), T., 340; P., 1900, 41.
- action of dry ammonia on (DIVERS and OGAWA), T., 327; P., 1900, 38; (DIVERS), P., 1900, 104.
- action of, on ammonia, and on fatty amines (SCHUMANN), A., ii, 271.
- action of iodides and hydriodic acid on (PÉCHARD), A., ii, 398; (BERG), A., ii, 535; (VOLHARD), A., ii, 650.
- estimation of (RUSSELL), T., 352; P., 1900, 41.

Sulphur dioxide, estimation of, in sulphites and thiosulphates (GRIFFIN), A., ii, 621.

Sulphur acids:—

Sulphuric acid, effect of concentration on the magnetic rotation of solutions of (FORCHHEIMER), A., ii, 524.

thermal capacity of solutions of (V. BIRON), A., ii, 63.

conductivity of aqueous solutions of hydrochloric acid and (BARNES), A., ii, 522.

migration constant of (KENDRICK), A., ii, 643.

surface-tension of mixtures of water and, and molecular mass of (LINEBARGER), A., ii, 273.

equilibrium between sulphates and, in aqueous solution (KAY), A., ii, 198.

relation between reactivity and concentration of (VAUBEL), A., ii, 650.

interaction of, with hydrogen peroxide (LOWRY and WEST), T., 950; P., 1900, 126.

action of, on potassium ferrocyanide (ADIE and BROWNING), T., 150; P., 1899, 226.

hydrates of (V. BIRON), A., ii, 74.

detection of, in presence of thiosulphates (DOBBIN), A., ii, 437.

test for selenium in (SCHLAGDENHAUFFEN and PAGEL), A., ii, 342.

estimation of, photometrically (HINDS), A., ii, 576.

estimation of, volumetrically (LITTERSCHID and FEIST), A., ii, 45.

estimation of, in presence of iron (WYROUBOFF), A., ii, 166; (KÜSTER and THIEL), A., ii, 242; (RICHARDS), A., ii, 472.

error in estimation of, in vegetable ashes (BOGDANOFF), A., ii, 160.

separation of, from vanadium (GOYDER), T., 1096.

Hyposulphurous acid (BERNTSEN and BAZLEN), A., ii, 203.

production of (NABL), A., ii, 13.

estimation of (FRADISS), A., ii, 44.

Sulphites and nitrites, interaction between (DIVERS and HAGA), T., 673; P., 1900, 70.

estimation of, in presence of thiosulphates (LUNGE and SEGALLER), A., ii, 366.

Persulphuric acids (LOWRY and WEST), T., 950; P., 1900, 126.

See also Caro's reagent.

Sulphur acids:—

Persulphates, action of, on iodine (MARSHALL), A., ii, 203.

estimation of (LE BLANC and ECKARDT), A., ii, 45.

Thiosulphuric acid, decomposition of (V. OETTINGEN), A., ii, 400; (HOLLEMAN), A., ii, 473.

estimation of, in presence of sulphites (LUNGE and SEGALLER), A., ii, 366.

Thiosulphates, action of, on iodates (JØRGENSEN), A., ii, 620.

Sulphur compounds, organic, critical temperatures of (FERRETTO), A., ii, 386.

Sulphur, estimation of:—

estimation of, in bitumens (S. F. and H. E. PECKHAM), A., ii, 44; (LANGMUIR), A., ii, 310.

estimation of, in iron (BLOUNT), A., ii, 574.

estimation of, in pig and cast iron (RIEMER), A., ii, 309.

estimation of, in pig iron (MOORE), A., ii, 106.

estimation of, in naphtha (LIDOFF), A., ii, 107.

estimation of, in ores, mattes, etc. (TRUCHOT), A., ii, 309.

estimation of, in organic substances (HENRIQUES), A., ii, 107.

estimation of, in petroleum (FRIEDLÄNDER), A., ii, 107.

estimation of, in pyrites (HEIDENREICH), A., ii, 310.

Sulphuric methylal. See Methylene sulphate.

Sulvanite from South Australia (GOYDER), T., 1094; P., 1900, 164.

Superfused substances, phenomenon noticed in the cooling of (MORESCHINI), A., ii, 465.

Superphosphates. See Agricultural Chemistry.

Suprarenal capsules, physiology of the (BORUTTAU), A., ii, 226; (MOORE and PURINTON), A., ii, 492.

aldehyde from the (JACOBY), A., i, 711.

extracts (MOORE and PURINTON), A., ii, 295.

influence of minimal doses of, on blood-pressure (MOORE and PURINTON), A., ii, 737.

gland, a depressor substance in the (HUNT), A., ii, 295.

Suprarenals, the catechol-like substance of the (V. FÜRTH), A., ii, 292.

Suprarenine (V. FÜRTH), A., ii, 292.

Surface layers of aqueous solutions, composition of (V. ZAWIDZKI), A., ii, 713.

Surface tension, conductivity and specific gravity of aqueous solutions containing potassium chloride and sulphate (BARNES), A., ii, 332.
 of organic liquids (DUTOIT and FRIDERICH), A., ii, 194.
 of solid bodies (OSTWALD), A., ii, 712.
 of mixtures of sulphuric acid and water (LINEBARGER), A., ii, 273.
Svanbergite (PRIOR), A., ii, 602.
Symphytoecynoglossine (GREIMER), A., i, 683.
Syrup, golden, analysis of (BODMER, LEONARD, and SMITH; MILLER and POTTS), A., ii, 320; (LEONARD; JONES), A., ii, 447; (MATTHEWS and PARKER), A., ii, 448.
 estimation of glucose syrup in (JONES), A., ii, 447.
 starch-, value of, in confections (KÖNIG), A., ii, 448.
Syrups, estimation of water in (MOLEND), A., ii, 309.

T.

Tacamahaca resin, examination of (DIETERICH), A., ii, 118.
Tachyhydrite, influence of pressure on the formation of (VAN'T HOFF and DAWSON), A., ii, 76.
ψ-Tagatose. See *l*-Sorbinose.
Tainiolite from Greenland (FLINK), A., ii, 411.
α-Tanacetogendicarboxylic acid (FROMM), A., i, 402.
Tanacetone (*thuyone*) and its derivatives (SEMMLER), A., i, 453.
 influence of active vegetable growth on the formation of (CHARABOT), A., ii, 362.
 formula of (SEMMLER), A., i, 240.
 conversion of, into carvotanacetone (SEMMLER), A., i, 676.
Tanacetone, pernitroso-, action of semicarbazide acetate on (RIMINI), A., i, 555.
Tanacetonedicarboxylic acid (SEMMLER), A., i, 453.
Tanacetyl alcohol (*thuyol*) (SEMMLER), A., i, 453.
 influence of active vegetable growth on the formation of (CHARABOT), A., ii, 362.
Tannic and gallic acids, estimation of (JEAN), A., ii, 632.
Tannin, estimation of (SPECHT and LORENZ), A., ii, 516.
Tanning materials, analysis of (PAESSLER), A., ii, 457.
Tannins of *Ardestaphylos Uva-ursi*, *Hematoxylon campechianum*, *Rhus Melopium*, *Myrica Gale*, *Coriaria Myrtifolia*, and *Robinia Pseudacacia* (PERKIN), T., 424; P., 1900, 45.
 of *Cortex Lokri* (VAN DEN DRIENEN-MARKEUW), A., ii, 102.
Tap cinder, estimation of iron in (BLUM), A., ii, 512.
Tar, Norwegian, composition of (STRÖM), A., i, 28, 577.
Tartar, crude, estimation of calcium malate in (ORDONNEAU), A., ii, 250.
Tartar emetics (BAUDRAN), A., i, 375; (PRUNIER), A., i, 376.
 See also Tartaric acid, potassium antimony salt of.
d-Tartaric acid, equilibrium between phenol, water and (SCHREINMAKERS), A., ii, 393.
 product of the destructive distillation of (SIMON), A., i, 624.
 colour test for (WOLFF), A., ii, 115.
d-Tartaric acid, beryllium alkali salts (ROSENHEIM and ITZIG), A., i, 185.
 cobalt and nickel salts, and double salts with potassium (TOWER), A., i, 587.
 copper alkali salts (BULLNHEIMER and SEITZ), A., i, 330.
 molybdo- and tungsto-alkali salts, specific rotatory power of (ROSENHEIM and ITZIG), A., i, 272.
 potassium antimony salt (*tartar emetic*), molecular weight of, by cryoscopic and boiling point methods (BATELLI and STEFANINI), A., ii, 709.
 action of sodium thiosulphate on (FAKTOR), A., ii, 598.
 potassium hydrogen salt, estimation of, in wine (MAGNIER DE LA SOURCE), A., ii, 768.
 potassium salts, metallic derivatives of. See also Tartar emetics.
d-Tartaric acid, ethyl ester, action of aniline and of hydroxylamine on (TINGLE), A., i, 544.
 action of ethyl iodide and sodium ethoxide on (BUCHER), A., i, 203.
 diethyl ester, preparation and rotation of acetyl and phenacetyl derivatives of (McCRAE and PATTERSON), T., 1096; P., 1900, 161.
l-Tartaric acid, copper alkali salts of (BULLNHEIMER and SEITZ), A., i, 330.
 Racemic acid, alkali double salts (SCHLOSSBERG), A., i, 376.
Tartromalic acids, α- and β- and their salts (ORDONNEAU), A., i, 203.

- Tartronic acid**, oxidation of, in presence of ferrous salts (FENTON and JONES), T., 71; P., 1899, 224.
- Taste of acid salts**, relation of, to their degree of dissociation (KAHLENBERG), A., ii, 270, 646; (RICHARDS), A., ii, 391.
- Tautomeric compounds**, optical behaviour of (BRÜHL), A., i, 497.
- Tautomerism**, spectrographic studies in (HARTLEY and DOBBIE), T., 498; P., 1900, 57; (HARTLEY, DOBBIE, and PALIATSEAS), T., 839; P., 1900, 130.
- Tea**, examination of (BRYTHIEN, BOHRISCH, and DEITER), A., ii, 455.
- Tellurium**, extraction and purification of (CRANE), A., ii, 473.
preparation of pure (NORRIS, FAY, and EDGERLY), A., ii, 272.
electrical resistance and specific gravity of (LENHER and MORGAN), A., ii, 273.
isomorphism of, with selenium (NORRIS and MOMMERS), A., ii, 537.
- Tellurium compounds**, physiological action of (GIES and MEAD), A., ii, 294.
- Telluriodates**, compounds of, with ammonium, potassium and rubidium (WEINLAND and PRAUSE), A., ii, 399.
- Tellurium nitrate**, basic, composition of (NORRIS, FAY, and EDGERLY), A., ii, 272.
dioxide, action of sodium thiosulphate on (NORRIS and FAY), A., ii, 272.
- Tellurous acid**, estimation of, in presence of haloid salts (GOOCH and PETERS), A., ii, 45.
- Tellurium organic compounds**:—
compounds of, with amines (LENHER), A., i, 379.
halogen salts, compounds of, with dimethylamine hydrochloride and hydrobromide (NORRIS and MOMMERS), A., ii, 537.
- Tellurium**, separation of, from selenium (CRANE), A., ii, 473; (KELLER), A., ii, 573.
- Telfairia oil and Telfairic acid** (THOMS), A., i, 473.
- Temperature**. See Thermochemistry.
- Tennantite**, identity of binnite with (PRIOR and SPENCER), A., ii, 21.
- Terephthalaldehyde tetracetate** (THIELE and WINTER), A., i, 501.
- Terephthalic acid**, bromo-, preparation and esterification of (WEGSCHEIDER and BITTNER), A., i, 658.
nitro-, preparation and esterification of, its salts, and the action of benzyl alcohol on it (WEGSCHEIDER), A., i, 657.
- Teresantalic acid** from East Indian sandalwood oil (GUERBER), A., i, 242; (MÜLLER), A., i, 678.
- $\Delta^{1,2}$ -Terpadiene**, 2-chloro-, and 2-chloro-bromo- (KLAGE and KRAITH), A., i, 43.
- $\Delta^{2(4,5)}$ -Terpadiene**, 3-chloro-, and chloro-tetrabromo-, from pulegone (KLAGE), A., i, 44.
- Terpene**, $C_{10}H_{16}$, from cascarilla oil, and its additive derivatives (THOMS), A., i, 622.
 $C_{10}H_{16}$, from oil of savin (FROMM), A., i, 402.
- Δ^1 -Terpene**. See Tetrahydrocymene.
- Terpenes**, genesis of, in lavender (CHARABOT), A., i, 241.
pseudo- and ortho-derivatives of (SEMMLER), A., i, 452.
- Terpenone**, $C_{10}H_{16}O$, constitution of (SEMMLER), A., i, 676.
- Terpin diformate** (BÉHAL), A., i, 581.
- Tetanus toxin**. See Toxin.
- Tetra-aniline antimonibromide** (HIGBEE), A., i, 285.
stanni-bromide and -chloride (RICHARDSON and ADAMS), A., i, 151.
- Tetra-aspartide** (SCHIFF), A., i, 279.
- Tetrabenzoyl**-. See under the Parent Substance.
- 2:2'-Tetrabenzoyldiamino-1:1'-dinaphthylmethane** (MORGAN), T., 814; P., 1900, 131.
- Tetracetoxytoluene** (THIELE and WINTER), A., i, 505.
- Tetracetoxy**-. See also under the Parent Substance.
- 2:2'-Tetraethyl-diamino-1:1'-dinaphthylmethane** (MORGAN), T., 814; P., 1900, 131.
- 1:2:3:4-Tetraethylbenzene**, refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.
- Tetraethylphosphonium compounds** (PARTHEIL), A., ii, 544.
- Tetraethylstibonium salts** (PARTHEIL and MANNHEIM), A., i, 479.
- Tetraethyltetrasulphone**, $\cdot CH_2[CH(SO_2Et)_2]_2$ and dibromo- (KÖRZ), A., i, 370.
- Tetrahedrite** (*faklore*), formula of (PRIOR and SPENCER), A., ii, 21.
- Tetrahydrobenzene**. See cycloHexene.
- Tetrahydrocarbazole**, transformations of (PLANCHER), A., i, 562.
- Tetrahydroapocinehenine** and its diacetyl derivative (KORNIOS), A., i, 246.
- Tetrahydrocymene** (Δ^1 -terpene), 2-chloro-, and 2-chlorobromo- (KLAGE and KRAITH), A., i, 43.

- Tetrahydrofurfuran-2:5-dicarboxylic acid**, its synthesis, hydrate and isomeric (LEAN), T., 105; P., 1899, 198.
- d-ac-Tetrahydro-β-naphthylamine*, racemisation occurring during the formation of benzylidene, benzoyl, and acetyl derivatives of (POPE and HARVEY), P., 1900, 74.
- Tetrahydroquinoline** and **Tetrahydroisoquinoline**, action of iodine on (SCHMIDT), A., i, 187.
- Tetrahydroquinolyl-2-propionic acid** and anhydride (KOENIGS), A., i, 250.
- Tetrahydrotoluene**, physical constants of, and compound of, with acetic chloride (KONDAKOFF and SCHINDLMEISER), A., i, 508.
- m-chloro-* (KLAGES), A., i, 44.
- Tetrahydroxyanthraquinone** and its acetyl derivatives (SLAMA), A., i, 181.
- Tetrahydroxyflavone**. See Luteolin.
- Tetrahydroxylic acid** (LRES and PERKIN), P., 1900, 20.
- Tetrahydroxytoluene** and its tetracetyl derivative (THIELE and WINTER), A., i, 505.
- 2:4:6:4'-Tetramethoxybenzoylacetophenone** (CZAJKOWSKI, V. KOSTANECKI, and TAMBOR), A., i, 504.
- Tetramethyldiaminobenzhydrol**, action of, on rosinduline and isorosinduline (MÜHLAU and SCHAPOSHNIKOFF), A., i, 367.
- Tetramethyldiaminobenzophenone**, action of, on *α*-dinaphthylbenzidine (MERZ and STRASSER), A., i, 314.
- Tetramethyldiaminobenzophenone-sulphone** (SACHS), A., i, 363.
- 2:2'-Tetramethyldiamino-1:1'-dinaphthylmethane** and **1:1'-Tetramethyldiaminodinaphthylmethane** (MORGAN), T., 823; P., 1900, 181.
- as-Tetramethyldiaminodiphenylethane* and its derivatives (TRILLAT), A., i, 252.
- action of nitrous acid on (TRILLAT), A., i, 192.
- Tetramethyldiaminodiphenylmethane**, preparation of (COHN), A., i, 608.
- Tetramethyldiaminodiphenylmethane-sulphone**, compound of, with nitroso-dimethylaniline (SACHS), A., i, 362.
- Tetramethyldiaminophenyl-carbinol** and **-methylcarbinol** (TRILLAT), A., i, 252.
- Tetramethylammonium cadmium haloids** (RAGLAND), A., i, 142.
- tin chlorides (COOK), A., i, 142.
- Tetramethylapionolearboxylic acid** (BIGNAMI and TESTONI), A., i, 400.
- α-Tetramethylbenzoic acid* (WEILER), A., i, 214.
- 1:3:4:6-Tetramethylecoumarone** (STOERMER), A., i, 653.
- Tetramethyl-decahydroacridinedione**, and **-octohydroxanthenedione** (VORLÄNDER and KALKOW), A., i, 99.
- s-Tetramethyldibenzyl*, synthesis of (WEILER), A., i, 213.
- Tetramethyldihydropyridone**, cyano-, action of heat on (GUARESCHI and GRANDE), A., i, 112.
- 4:6:6:8-Tetramethyl-6:7-dihydroquinocoumarin** (V. PECHMANN), A., i, 173; (V. PECHMANN and SCHWARZ), A., i, 174.
- Tetramethylenedicarboxylic acid**. See *cyclo*Butanedicarboxylic acid.
- Tetramethylene-1:3-disulphone**, dimethyl and diethyl derivatives of (KÖRTZ), A., i, 369.
- Tetramethylethyl-octohydro-xanthenedione** (VORLÄNDER and KALKOW), A., i, 100.
- s-Tetramethylglutaric acid* and its salts and anhydride (MICHAILENKO and JAVORSKY), A., i, 586.
- α,β-Tetramethylglutaric acids*, (*heptanedicarboxylic acids*) (THORPE), T., 932; (THORPE and YOUNG), T., 936; P., 1900, 114.
- Tetramethylhematoxylin**, oxidation of (PERKIN and YATES), P., 1900, 107.
- Tetramethylhematoxylone**, melting point of (GILBODY and PERKIN), P., 1899, 241.
- Tetramethylphosphonium compounds** (PARTHEIL), A., ii, 544.
- Tetramethylpyridone**, 3-cyano-1:2:3:4-, physiological action of (SABBATANI), A., ii, 94.
- Tetramethylpyrone** and its hydrate and salts (COLLIE and STEELE), T., 961; P., 1900, 146.
- periodide (COLLIE and STEELE), T., 1114; P., 1900, 164.
- Tetramethylpyrrolinocarboxylic acid**, amides of (PAULY and BOEHM), A., i, 357.
- Tetraphenylamine**, diamino-. See Dixerilamine, diamino-.
- Tetraphenyl-β-diketopiperazine** (HENZE), A., i, 119.
- Tetraphenylguanidine**, preparation of (V. BRAUN), A., i, 642.
- Tetraphenyl-*o*-phenylenediamine**, nitro- (HAUSSERMAN), A., i, 365.
- Tetraphenylpyrrolone** (KLOBB), A., i, 406.
- Tetrapropylstibonium salts** (PARTHEIL and MANNHEIM), A., i, 480.
- Tetra-*n*- and -*iso*-propyltetrasulphones**, $\text{CH}_3[\text{CH}(\text{SO}_2\text{Pr})_2]_2$ (KÖRTZ), A., i, 370.

Tetrasulphones, $\text{CH}_2[\text{CH}(\text{SO}_2\text{R})_2]$, reactivity of the hydrogen atoms in (KÖTZ), A., i, 369.

Tetrazine derivatives, conversion of, into triazole derivatives (HANTZSCH and SILBERRAD), A., i, 263; (BUSCH and HEINRICHS), A., i, 314.

Tetronal, chemico-toxicology of (VITALI), A., ii, 774.

Tetronic acid, chloro-, chlorobromo-, and iodo- (WOLFF and FERTIG), A., i, 585. nitro- and amino-, and their derivatives (WOLFF), A., i, 582; (WOLFF and LÜTTRINGHAUS), A., i, 583.

Tetronosulphonic acid (WOLFF and FERTIG), A., i, 586.

Thallium halogen salts, isomeric, and their constitution (CUSEMAN), A., ii, 725.

Thallium, tribromide, trichloride, and trinitrate (MEYER), A., ii, 655. trichloride, effect of oxidising agents on the reduction of, by oxalic acid (KASTLE and BEATTY), A., ii, 627.

compounds of, with organic bases (MEYER), A., ii, 655.

permanganate (MEYER and BEST), A., ii, 78.

nitrate, formation and transformation of the double salts of silver nitrate and (VAN EIJK), A., ii, 403.

persulphate (MARSHALL), A., ii, 277.

Thallie sulphate, hydrolysis of (MARSHALL), A., ii, 207.

Thallium, estimation of:—

estimation of (THOMAS), A., ii, 442.

estimation of, as chromate (BROWN-ING and HUTCHINS), A., ii, 172.

estimation of, as sulphate (BROWN-ING), A., ii, 247.

Thebaol, constitution of (PSCHORR), A., i, 234.

α - ψ -Thebaol (6-hydroxy-1:5-dimethoxy-phenanthrene), synthesis of (PSCHORR), A., i, 233.

α - ψ -Thebaolcarboxylic acid (6-hydroxy-1:5-dimethoxyphenanthrene-10-carboxylic acid) and its acetyl derivative (PSCHORR), A., i, 234.

Theobromine, decomposition of, in the organism (KRÜGER and SCHMIDT), A., ii, 31.

action of, on the heart (BOCK), A., ii, 424.

THERMOCHEMISTRY:—

Thermochemical law of maximum work (REYCHLER), A., ii, 258.

Thermodynamics and permanent change (DUHEM), A., ii, 524, 708. of normal cells (COHEN), A., ii, 520, 703.

THERMOCHEMISTRY:—

Thermokinetic properties of solutions (NATANSON), A., ii, 191.

Thermo-electrical properties of alloys (STEINMANN), A., ii, 523, 524.

Heat, absorption of, by the association of liquid molecules (VAN LAAR), A., ii, 189.

action of, on hydrogenised compounds (GUARESCHI and GRANDE), A., i, 112.

developed by starch by the absorption of water (RODEWALD and KATTEIN; RODEWALD), A., i, 477.

Thermal capacity of cobalt chloride solutions (WREWSKY), A., ii, 63.

of sulphuric acid solutions (v. BIRON), A., ii, 63.

centres of stability in compounds (MARTIN), A., ii, 589.

value of coefficients of acidity and influence (DE FORCRAND), A., ii, 527, 528.

of the hydroxyl function (DE FORCRAND), A., ii, 526.

Temperature, influence of, on the electrical conductivity of dilute amalgams (LAESEN), A., ii, 255.

of maximum density of solutions of ammonium chloride, lithium bromide and iodide (DE COPPET), A., ii, 529.

influence of, on the specific rotation of mono- and di-acetyl- and -phenacetyl-tartrates (McCRAE and PATTERSON), T., 1106.

of boiling mixtures of salts and steam (BUCHANAN), A., ii, 710.

of the body during fasting, and the speed of assimilation of carbohydrates, proteids and fats (Mosso), A., ii, 605.

Temperatures, fixed, tubular furnace giving (GAUTIER), A., ii, 258.

low, measurement of; boiling and melting points (LADENBURG and KRÜGEL), A., ii, 258.

very low, effect of, on the colour of bromine and iodine compounds (KASTLE), A., ii, 526.

Temperature coefficient of the driving tendency of physicochemical reaction (RICHARDS), A., ii, 533.

of conductivity of some liquid ammonia solutions (FRANKLIN and KRAUS), A., ii, 645.

of ester hydrolysis (PRICE), A., ii, 528.

Critical constants and temperature. See under Critical.

Transition temperatures, determination of (DAWSON and WILLIAMS), P., 1899, 210.

THERMOCHEMISTRY :—*Heat of formation* = *f.*; of *transformation* = *t.*; of *dissociation* = *dis.*; of *combustion* = *c.*; of *neutralisation* = *n.*; of *hydration* = *h.*; of *oxidation* = *o.*

Transition temperatures, new method of determining (COHEN), A., ii, 188.

of monotropic dimorphous substances, determination of the (SCHENCK), A., ii, 465.

of optical isomerides (ADRIANI), A., ii, 462.

of ammonium nitrate, change of, through the addition of potassium nitrate (MÜLLER), A., ii, 188.

of mercuric iodide (GERNEZ), A., ii, 141.

effect of various solvents on the (KASTLE and CLARK), A., ii, 141.

of mixed crystals of sodium and potassium nitrates and of sodium and silver nitrates (HISSINK), A., ii, 339.

of mixed crystals of potassium and thallium nitrates (VAN ELJK), A., ii, 133.

of hepta- and hexa-hydrates of zinc sulphate (BARNES), A., ii, 254.

Manostat (SMITS), A., ii, 388.

Thermocalorimeter, overflowing (MARSH), A., ii, 386.

Thermostats (BODENSTEIN), A., ii, 12.

Heat conductivity, change of, during melting (VAN AUBEL), A., ii, 128.

of gases (SMOLUCHOWSKI and V. SMOLAN), A., ii, 63.

of mixtures and of their constituents (LEES), A., ii, 338.

of nitrogen tetroxide (MAGNANINI and ZUNINO), A., ii, 525.

Atomic heats, additivity of (MEYER), A., ii, 464.

Specific heat and atomic weights (TILDEN), A., ii, 524.

of fluids (AMAGAT), A., ii, 525.

of alloys at low temperatures (BEHN), A., ii, 259.

of metals (TILDEN), A., ii, 524.

at low temperatures (BEHN), A., ii, 259.

of graphite at low temperatures (BEHN), A., ii, 259.

of nitriles and other organic compounds (LUGININ), A., ii, 334.

of cellulose, wool and leather (FLEURY), A., ii, 188.

of wheat starch (RODEWALD and KATTEIN), A., i, 477.

of blood (BORDIER; BERTHELOT), A., ii, 356.

Latent heat of fusion, effect of temperature or pressure on the (TAMMANN), A., ii, 714.

Heat of formation, supposed negative, of some carbon compounds (VAUBEL), A., ii, 274.

Heat of neutralisation of acids and bases and electrolytic dissociation (THIEL), A., ii, 260.

of acids, in alcohol, by ammonia and by potassium hydroxide (TANATAR and KLIMENKO), A., ii, 713.

Heat of vaporisation of air and of carbon dioxide (BEHN), A., ii, 260.

of nitriles and other organic compounds (LUGININ), A., ii, 334.

Thermochemical data of hyperacids (*n.* and *o.*) (PISSARJEWSKY), A., ii, 466.

of alloys (*f.*) (TAYLER; GLADSTONE), A., ii, 710.

of alloys of copper and zinc (*f.*) (BAKER), P., 1899, 195; (GALT), A., ii, 189.

of alkali hydroxides, and of ammonia and methylamine with hydrogen peroxide (*n.*) (DE FORCRAND), A., ii, 476.

of compounds of barium hydroxide and hydrogen peroxide (*f.* and *n.*) (DE FORCRAND), A., ii, 278.

of hydrated barium peroxide (*f.*) (DE FORCRAND), A., ii, 344.

of calcium peroxide (*f.*) (DE FORCRAND), A., ii, 526.

of hydrates of calcium peroxide (*f.*) (DE FORCRAND), A., ii, 401, 479.

of hydrogen fluoride (*dis.*) (ABEGG), A., ii, 190.

of hydrogen peroxide by basic hydroxides (*n.*) (DE FORCRAND), A., ii, 476.

of hydrogen peroxide by lime (*n.*) (DE FORCRAND), A., ii, 526.

of compounds of lithium bromide and gaseous ammonia (*f.*) (BONNEFOI), A., ii, 478.

of hydrated lithium peroxide (*f.*) of lithium peroxide (*f.*) (DE FORCRAND), A., ii, 478.

of sodium dioxide, hydrate of (*f.*) (DE FORCRAND), A., ii, 129.

of hydrated and anhydrous strontium dioxide (*f.*) (DE FORCRAND), A., ii, 344.

of tungsten (*o.*) (DELEPINE and HALLOPEAU), A., ii, 8; (DELEPINE), A., ii, 548.

of very volatile liquids (*c.* and *f.*) (BERTHELOT and DELEPINE), A., ii, 334.

of *n*-adipic acid (*f.* and *n.*) (MASSOL), A., ii, 260.

THERMOCHEMISTRY :—*Heat of formation* = *f.*; of *transformation* = *t.*; of *dissociation* = *dis.*; of *combustion* = *c.*; of *neutralisation* = *n.*; of *hydration* = *h.*; of *oxidation* = *o.*

Thermochemical data of ammonium cyanate (*f.* and *t.*) (WALKER and WOOD), T., 27; P., 1899, 209.
 of *cacodylic acid* (*n.*) (IMBERT), A., i, 145.
 of *carbonylhydroferrocyanic and hydroferrocyanic acids* (*n.*) (MULLER), A., ii, 130.
 of *diethylenediamine* (*c.*, *f.*, *h.*, and *n.*) (BERTHELOT), A., i, 83.
 of *gallic acid* (*n.*) (MASSOL), A., i, 499.
 of *hemipinic acid* (*c.* and *f.*) (LEROY), A., ii, 261.
 of *organic iodine compounds* (*c.* and *f.*) (BERTHELOT), A., ii, 387.
 of *salts of lactic acid and of lactide* (*c.*, *f.*, and *n.*) (BERTHELOT and DELÉPINE), A., ii, 130.
 of *lithium chloride compounds with ethylamine* (*f.*) (BONNEFOI), A., ii, 130.
 of *substituted malonic acids, compared with that of dibasic acids* (*n.*) (MASSOL), A., i, 200.
 of *meconin* (*c.*, *f.*, and *o.*) (LEROY), A., ii, 261.
 of *mercury-dimethyl, -diethyl, and -diphenyl* (*c.* and *f.*) (BERTHELOT), A., ii, 130.
 of *methylene sulphate* (*c.* and *f.*) (DELÉPINE), A., i, 130.
 of *narceine, its hydrates, hydrochloride and potassium derivative* (*c.*, *f.*, *h.*, and *n.*) (LEROY), A., ii, 131.
 of *opianic acid* (*c.*, *f.*, *n.*, and *o.*) (LEROY), A., ii, 261.
 of *protocatechuic acid* (*f.* and *n.*) (MASSOL), A., i, 600.
 of *thiocyanates and thiocarbimides* (*c.*, *f.*, and *t.*) (BERTHELOT), A., ii, 261.
 of *2:3:4-trihydroxybenzoic acid* (*n.*) of the *sodium salt* (*f.*) (MASSOL), A., i, 499.
 of the *uric acid series* (*c.* and *f.*) (BERTHELOT), A., ii, 189.
 of *violic acid and of water* (*dis.*) (ABEGG), A., ii, 190.
 of *marcasite and pyrites* (*c.*) (CAVAZZI), A., ii, 598.
 of *human fat* (*c.*) (BENEDICT and OSTERBERG), A., ii, 491.
Heat of solution, relation between solubility and, of electrolytes (VAN LAAR), A., ii, 708.
 of *salts, influence of the medium on* (GALITZKI), A., ii, 66.
 of *hydrogen peroxide* (DE FORCRAND), A., ii, 526.

Heat of solution of iron and steel (CAMPBELL), A., ii, 407.
 of *compounds of lithium bromide and gaseous ammonia* (BONNEFOI), A., ii, 478.
 of *lithium chloride compounds with ethylamine* (BONNEFOI), A., ii, 130.
 of *lithium peroxide and its hydrate* (DE FORCRAND), A., ii, 478.
 of the *hydrate of sodium dioxide* (DE FORCRAND), A., ii, 129.
 of *ammonium cyanate* (WALKER and WOOD), T., 27; P., 1899, 209.
 of *n-potassium adipate* (MASSOL), A., ii, 261.
 of *diethylenediamine* (BERTHELOT), A., i, 83.
 of *gallic acid* (MASSOL), A., i, 499.
 of *salts of lactic acid and of lactide* (BERTHELOT and DELÉPINE), A., ii, 130.
 of *opianic acid* (LEROY), A., ii, 261.
 of *protocatechuic acid* (MASSOL), A., i, 600.
 of *2:3:4-trihydroxybenzoic acid and its sodium salt* (MASSOL), A., i, 499.
Thetine, $C_6H_{11}O_2S$ (STRÖMHOLM), A., i, 326.
Thetine bromide, reactions of (STRÖMHOLM), A., i, 326.
 derivatives, attempts to resolve (STRÖMHOLM; VANZETTI), A., i, 327.
 resolution of (POPE and PEACHEY), T., 1072, P., 1900, 12.
Thiasine colouring matters, blue (SCHAFOSCHNIKOFF), A., i, 523.
 structure of (GREEN), A., i, 119.
Thioantimonites (POUGET), A., ii, 84.
Thiocarbamide, action of, on ethyl phenylpropiolate (RUHEMANN and STAPLETON), T., 242; P., 1900, 12.
 derivatives of *diacetoneamine* (TRAUBE and LORENZ), A., i, 115; (TRAUBE and SCHALL), A., i, 118.
Thiocarbamides, aromatic, convenient method for the preparation of (v. BRAUN), A., i, 644.
 action of *hydrazine* on (BUSCH and BAUER), A., i, 414.
 acyl derivatives of, isomerism and constitution of (HUGERSHOFF), A., i, 155.
Thiocarbimides from plants (GADAMER), A., i, 49; (TER MEULEN), A., i, 511.
 isomeric, thermochemistry of (BERTHELOT), A., ii, 261.

- Thiocarbonic acid**, diethyl ester, phenylhydrazone of (WHEELER and BARNES), A., i, 565.
- diThiocarbonic acid**, hydrazones of esters of (BUSCH and LINGENBRINK), A., i, 66, 411.
- Thiocyanic acid**, double salts of (MIOLATI; ROSENHEIM and COHN), A., i, 381.
- oxycobaltamine salts of (MASCETTI), A., i, 541.
- Thiocyanates**, double, electrical conductivity of (WALDEN), A., i, 430.
- isomeric, thermochemistry of (BERTHELOT), A., ii, 261.
- Thiocarbamic acid**, esters, acyl derivatives of (WHEELER and JOHNSON), A., i, 632.
- Thiols**. See Mercaptans.
- Thiocarbamic acid**, esters, action of chloroacetic acid on (WHEELER and BARNES), A., i, 565.
- acyl derivatives of, preparation and behaviour of, with alkyl iodides and amines (WHEELER and JOHNSON), A., i, 632.
- Thiocarbanilic acid**, esters, molecular rearrangement of, and action of chloroacetic acid on (WHEELER and BARNES), A., i, 565.
- Thionyl-methyl- and -ethyl-anilines** and their salts (MICHAELIS and SCHINDLER), A., i, 215.
- Thiosulfates**, preparation of (HEMPEL and V. HAASY), A., ii, 275.
- Thorium compounds**, rays from (CURIE), A., ii, 81; (P. and S. CURIE; P. and S. CURIE and BÉMONT), A., ii, 82.
- a radio-active substance from (RUTHERFORD), A., ii, 351, 352.
- Thorium salts** (ROSENHEIM and SCHILLING), A., ii, 351.
- Thorium chloride and bromide**, compounds of, with hydrogen chloride and pyridine (ROSENHEIM and SCHILLING), A., ii, 351.
- nitrate, purification of commercial (MUTHMANN and BAUR), A., ii, 597.
- double nitrates of quadrivalent (MEYER and JACOBY), A., ii, 597.
- oxide (*thoria*), luminosity of mixtures of ceria and (THIELE), A., ii, 208.
- Thujaketoneoxime**, bases from, and reactions of (WALLACH), A., i, 45.
- Thujamenthone and isoThujone**, formulæ of (SEMMLER), A., i, 240.
- Thujol**. See Tanacetyl alcohol.
- Thujone**. See Tanacetone.
- Thymic acid**, solubility of uric acid in (KOSSEL and GOTO), A., ii, 421; (GOTO), A., ii, 740.
- Thymin** (JONES), A., i, 319.
- preparation of (JONES), A., i, 572.
- dichloro-** (STEUDEL and KOSSEL), A., i, 467.
- Thymol**, sodium derivative of, compounds of, with the ethyl esters of α -bromo-fatty acids (BISCHOFF), A., i, 394.
- 2:6-bromonitro- and -chloronitro- (KEHRMANN and SCHOEN), A., i, 181.
- Thymoquinonebenzoylphenylhydrazone** (McPHERSON), A., i, 124.
- Thymoquinoneoximes**, 3- and 6-bromo-, -chloro-, and -iodo- and their acyl derivatives (KEHRMANN and KRÜGER), A., i, 180.
- Thymoxyacetal** (STOERMER), A., i, 653.
- α -Thymoxy-propionic, -n- and -iso-butyric, and -isovaleric acids** and their ethyl esters (BISCHOFF), A., i, 394.
- Thymus and Thyroid glands**. See Gland.
- Tin**, enantiotropy of (COHEN and VAN EIJK), A., ii, 83, 212; (COHEN), A., ii, 212, 408.
- Tin compounds**, asymmetric optically active (POPE and PEACHER), P., 1900, 42, 116.
- analyses of (MENNICKÉ), A., ii, 668, 761.
- Tin alloys with antimony** (REINDERS), A., ii, 731.
- Tin chlorides and bromides**, compounds of, with anilines (RICHARDSON and ADAMS), A., i, 151.
- compounds of, with the methylamines and tetramethylammonium and the ethylamines (COOK), A., i, 142.
- Stannic chloride**, hydrolysis of (v. KOWALEWSKY), A., ii, 256; (KOHLRAUSCH), A., ii, 409.
- compound of, with nitrosyl chloride (VAN HETEREN), A., ii, 137.
- Stannous chloride**, use of, in Bettendorff's test for arsenic (DIETZ; ENELL; FREERICHs), A., ii, 244.
- Metastannic acid**, absorption of hydrogen and potassium chlorides from aqueous solution by (VAN BEMMELEN and KLOBBIE), A., ii, 338; (VAN BEMMELEN), A., ii, 466.
- Tin**, detection, estimation and separation of:—
- test for (ROGERS), A., ii, 445.
- detection of, by ammonium molybdate (LONGSTAFF), A., ii, 313.
- estimation of, in preserved meat, and the state in which it occurs (WIRTHELE), A., ii, 512.
- separation of, from antimony and arsenic (MARBURG), A., ii, 248.

- Tin ores** from Banca and Billiton (BECK), A., ii, 784.
- Tissues**, animal, different effect of ions on (LOEB), A., ii, 357.
- oxidation in (MEDVEDEFF), A., ii, 738.
- chemico-physical relations of juices and (ØKER-BLOM), A., ii, 290, 356, 607.
- connective, coagulable proteids of (GIES and RICHARDS), A., ii, 292.
- separation of, from muscle (GOODMAN), A., ii, 671.
- fibrous, hydrolysis of (ÉTARD), A., i, 468.
- white fibrous, glucoproteids of (GIES and CUTTER), A., ii, 293.
- nerve. See Nerves.
- estimation of alcohol in, in acute alcoholism (GRÉHANT), A., ii, 95, 112.
- estimation of urea in (GOTTLIEB), A., ii, 57.
- Titaniferous iron ores**, analysis of (BASKERVILLE), A., ii, 629.
- Titanium**, occurrence of, in flesh and bones (BASKERVILLE), A., ii, 226.
- tetrachloride, hydrolysis of (v. KOWALEWSKY), A., ii, 731.
- Titanium**, estimation of, in iron ores (BRAKES), A., ii, 248; (POPE), A., ii, 409.
- Tobacco**, chemistry of (KISSLING), A., ii, 640.
- New South Wales, amount and estimation of nicotine in (HARKER), A., ii, 778.
- See also Agricultural Chemistry.
- Tobacco smoke**, constituents of (THOMS), A., ii, 428.
- action of the carbonic oxide in, on the organism (WAHL), A., ii, 221.
- Tolane**, refraction of (CHILESOTTI), A., i, 339.
- crystalline form of (BOERIS), A., i, 544.
- p*-Tolonyliminomethyl ether, re-arrangement of (WHEELER and ATWATER), A., i, 294.
- Tolidine**, colour test for (WOLFF), A., ii, 119.
- Toluene**, refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.
- density of (v. HIRSCH), A., ii, 9.
- oxidation of (WEILER), A., i, 283.
- Toluene**, *o*- and *p*-chloro-, electrolytic preparation of (VOTOČEK and ZENÍŠEK), A., i, 19.
- 2:4:5-trichloro- (MORGAN), T., 1204.
- m*-chloro- *mono*- and -4:6-*di*-nitro-, and their reduction products (REVERDIN and CRÉPIEUX), A., i, 638.
- (*Toluene compounds Me=1.*)
- Toluene**, *p*-chloro-*o*-iodo-, and *p*-chloro-*o*-nitro- and the *iso*-compound (VAN RAALTE), A., i, 147.
- fluoro-, fluorochloro- and fluorochloro-nitro-derivatives of (SWARTS), A., i, 637.
- m*-iodoso- and its acetate (ORTOLEVA), A., i, 592.
- m*-iodoxy- (BAMBERGER and HILL), A., i, 281; (ORTOLEVA), A., i, 592.
- m*-nitro-, electrolytic reduction of (ROHDE), A., i, 20.
- p*-nitro-, action of sodium on (SCHMIDT), A., i, 20.
- o*-*is*onitro- (BAMBERGER), A., i, 500.
- Tolueneariminol**. See 1-Hydroxy-6-methyl-1:2:3-benzotriazole.
- p*-Toluenearazo-4-chloro-*m*-phenylenediamine (COHN and FISCHER), A., i, 458.
- o*-Toluenearazotolylcarbamie acid, ethyl ester (BUSCH and HARTMANN), A., i, 59.
- Toluenenitroic acid**, *d*initro-, salts of (HANTZSCH and KISSEL), A., i, 89.
- p*-Toluenesulphopropyl-amide and -*iso*-butylamide (MARCKWALD), A., i, 143.
- Toluenetricarboxylic acid** (DOEBNER), A., i, 500.
- o*-Toluidine, 5-chloro- (REVERDIN and CRÉPIEUX), A., i, 638.
- m*-Toluidine, 4:6-*dichloro*- (REVERDIN and CRÉPIEUX), A., i, 645.
- p*-Toluidine, compressibility of (HULETT), A., ii, 398.
- 3-chloro- (REVERDIN and CRÉPIEUX), A., i, 638.
- o*- or *p*-Toluidine, 5:4- or 3:6-chloro-nitro-, and its acetyl derivative (REVERDIN and CRÉPIEUX), A., i, 638.
- o*- and *p*-Toluidine hydrochlorides, double salts of, with bismuth chloride (HAUSER and VANINO), A., i, 641.
- Toluidines**, bromination of (FISCHER and WINDAUS), A., i, 485.
- antimonio-bromides, -chlorides, and -iodides of (HIGBEE), A., i, 285.
- "*o*-Toluidine, cyano-" and its acetyl derivative (MEVES), A., i, 483.
- o*-Toluidineosmellie acid (HEFFTER and FEUERSTEIN), A., i, 498.
- 5-Toluidine-4-*o*- and -*p*-tolyltriazoles, and the 3-methyl derivative of the para-compound (BUSCH and BAUER), A., i, 415.
- p*-Toluiline (*tri-p*-tolylglyoxaline) and its salts (PIEPES-PORATYŃSKI), A., i, 648.
- p*-Toluenitrile, polymerisation of (PIEPES-PORATYŃSKI), A., i, 648.
- p*-Toluoyl-*o*-benzoic acid, compounds from (LIMPRICHT and WIEGAND), A., i, 498.

(Tolyl compounds $Me=1$.)

- p*-Toluoyle-*p*-benzoic acid (LIMPRICHT), A., i, 598.
- p*-Toluoylearbinolbenzoic acid (LIMPRICHT), A., i, 598.
- p*-Toluoyle- β -propionic acid (LIMPRICHT), A., i, 600.
- Tolu-quinol and -quinone, tetrabromo- (AUWERS; AUWERS and HAMPE), A., i, 97.
- Toluquinone, tribromo- (AUWERS and V. ERGGELET; AUWERS and BURROWS), A., i, 98.
- pentabromo- (AUWERS and BURROWS), A., i, 98.
- Toluquinonebenzoylphenylhydrazine (MCPHERSON), A., i, 123.
- o*-Toluquinonehydrazones (FARMER and HANTZSCH), A., i, 123.
- Toluquinoneoxime ethers, space isomerism of (MORGAN), A., i, 103.
- Toluquinonephenylhydrazine (MCPHERSON), A., i, 123.
- Toluric acids, *o*- and *p*-, ethyl esters (RÜGHEIMER and FEHLHABER), A., i, 609.
- Toluroflavins, *o*- and *p*- (dimethylhipuroflavins) and their anilides, and toluidides (RÜGHEIMER and FEHLHABER), A., i, 609.
- p*-Tolylacetylene and α -chloro- (KUNCKELL and GOTSCH), A., i, 638.
- Tolyl acetyl nitrogen chlorides and bromides, *o*- and *p*- (acetyl-chloro- and -bromo-aminotoluenes) (CHATTAWAY and ORTON), T., 790; P., 1900, 102.
- 3-*p*-Tolylbenzoxazine, 6-nitro-, and its carbanilide (WERNER and HERBERGER), A., i, 58.
- p*-Tolylisobutyric acid (WALLACH), A., i, 229.
- p*-Tolylcarbasinic- α -carboxylic acid, esters of (BUSCH and LINGENBRINK), A., i, 413.
- Tolylguanides (BEUTEL), A., i, 367.
- m*-Tolylenediamine, difference of basicity of the amino-groups in (BÜLOW), A., i, 690.
- 2,4-Tolylenediamine, 5-chloro- and its acetyl derivatives (MORGAN), T., 1204; P., 1900, 170; (REVERDIN and CRÉPIEUX), A., i, 638.
- p*-Tolylethylene, $\alpha\beta$ -dichloro- (KUNCKELL and GOTSCH), A., i, 638.
- p*-Tolyl-*p*-hydroxybenzylidenemethylhydrazine (LABHARDT and V. ZEMBRZUSKI), A., i, 125.
- 3-Tolyl-4'-hydroxyphenylamine, 4:6-dinitro- (REVERDIN and CRÉPIEUX), A., i, 638.

(Tolyl compounds $Me=1$.)

- 3-Tolylimino-2-*p*-tolyl-7-methylphenotriazine and its salts and the dihydrotriazine (BUSCH and HARTMANN), A., i, 59.
- Tolylimino-*o*- and -*p*-tolyltetrazolones, *o*- and -*p*- (BUSCH and BAUER), A., i, 415.
- 2-Tolylketo-7-methyl-phenotriazine and -dihydrophenotriazine (BUSCH and HARTMANN), A., i, 59.
- m*- and -*p*-Tolyl mercaptans (BOURGOIS), A., i, 163.
- p*-Tolyl- α -methylhydrazine (LABHARDT and V. ZEMBRZUSKI), A., i, 125.
- 1-*p*-Tolyl-3-methylpyrazole and its halogen and nitro-derivatives and their salts (MICHAELIS and SUDENDORF), A., i, 696.
- 7-*o*-Tolyl-naphthaphenazonium, 7-chloro-, salts of (FISCHER and HEPP), A., i, 461.
- 3-Tolyl- α -naphthylamine, 4:6-dinitro- (REVERDIN and CRÉPIEUX), A., i, 638.
- p*-Tolyl-*o*-, -*m*-, and -*p*-nitrobenzylidenemethylhydrazine (LABHARDT and V. ZEMBRZUSKI), A., i, 125.
- Tolylloxides, sodium, compounds of, with the ethyl esters of α -bromo-fatty acids (BISCHOFF), A., i, 392.
- Tolylloxacetones, *o*-, *m*-, and *p*-, and their oximes, phenylhydrazones, and semicarbazones (STOERMER), A., i, 651.
- β -*m*-Tolylloxycinnamic acid, and its ethylester (RUHEMANN and BEDDOW), T., 1119; P., 1900, 165.
- β -Tolylloxycinnamic acids, *o*- and *p*-, and their ethyl esters (RUHEMANN and BEDDOW), T., 984; P., 1900, 123.
- Tolylloxymaleic acids, *o*-, *m*-, and *p*-, and their ethyl esters (RUHEMANN and BEDDOW), T., 1124; P., 1900, 165.
- m*-Tolylloxymaleic acid (RUHEMANN and BEDDOW), T., 1125; P., 1900, 165.
- Tolyllox-propacetals, -propaldehydes and their oximes and semicarbazones, and -propionic acids, *o*-, *m*-, and -*p*- (STOERMER), A., i, 651.
- α -Tolyllox-propionic, -*n*- and -isobutyric, and -isovaleric acids, *o*-, *m*-, and *p*-, and their ethyl esters (BISCHOFF), A., i, 392.
- m*-Tolylloxystyrene (RUHEMANN and BEDDOW), T., 1119; P., 1900, 165.
- o*- and -*p*-Tolylloxystyrenes (RUHEMANN and BEDDOW), T., 984; P., 1900, 123.
- Tolylpyridazinone (LIMPRICHT), A., i, 600.
- p*-Tolylpyrrolidone (TAFEL and STERN), A., i, 558.

(*Tolyl compounds Me=1.*)

- 7-*o*-Tolyl-isorosindone**, and -rosindone and its oxime (FISCHER and HEPP), A., i, 461.
- p*-Tolylrosindulines**, and their salts (FISCHER and HEPP), A., i, 462.
- p*-Tolylaposafranine** and its salts (FISCHER and HEPP), A., i, 460.
- p*-Tolylthiocarbimide**, action of, on *o*-aminoazotoluene (BUSCH and HARTMANN), A., i, 59.
- o*-Tolylthionine** and its salts (SCHAPOSCHNIKOFF), A., i, 524.
- v*-Tolylthiosulphonacetacetic acid**, ethyl ester (TROEGER and EWERS), A., i, 495.
- Tolyltrimethylammonium iodides**, *o*-, *m*-, and *p*-, 5-, 6-, and 8-bromo- (FISCHER and WINDAUS), A., i, 484.
- p*-Tolyl-*as-m*-xylyliodonium hydroxide** and salts (WILLGERODT and HOWELLS), A., i, 338.
- Tolylxylylphthalide** (LIMPRICHT), A., i, 599.
- Tolypyrrine**, reactions of (HOFFMANN), A., ii, 379.
- Tomatoes**, detection of foreign colouring matters in preserved (HALPHEN), A., ii, 700.
- See also Agricultural Chemistry.
- Tonalite** from Cape Marsa (DUPARC and PEARCE), A., ii, 219.
- from the eruptive rocks from the Salzkammergut (V. JOHN), A., ii, 219.
- Topaz** from Japan (JIMBŪ), A., ii, 87.
- Tourmaline**, constitution of (PENFIELD), A., ii, 602; (BEERMANN), A., ii, 663.
- from Elba (MANASSE), A., ii, 287.
- estimation of boric acid in (SARGENT), A., ii, 47.
- Tourmaline mixtures**, theory of (TSCHERMAK), A., ii, 217.
- Toxin**, snake, and toxic sera, hæmolytic action of (STEPHENS), A., ii, 228.
- tetanus, action of, on nerve tissue (DANTSZ), A., ii, 156.
- and antitoxin, the intravenous injection of (RANSOM), A., ii, 558, 608.
- Toxins**, combination of, with nucleins (STASSANO), A., ii, 559.
- Trachyte-tuff**, cinnabar-bearing from South Tuscany (KLOOS), A., ii, 733.
- Tragacanth**. See Gum.
- Transparency** of various liquids to electric oscillations (DE HEEN), A., ii, 524.
- Treacle**, analysis of (MATTHEWS and PARKER), A., ii, 448.
- estimation of glucose syrup in (JONES), A., ii, 447.

VOL. LXXVIII. ii.

- Trehalose**, fermentation experiments with (BAU), A., ii, 98.
- and its compounds with lime and strontia and its benzoyl derivatives (SCHUKOFF), A., i, 628.
- Triacetaldehydes**, trithio- (FROMM), A., i, 14.
- Triacetoneamine**, dibromo-, action of amines on (PAULY and BOEHM), A., i, 357.
- Triacetonedibenzamidine** (TRAUBE and SCHWARZ), A., i, 117.
- 1:2:3-Triacetoxyanthraquinone**, its halogen derivatives (SLAMA), A., i, 182.
- 1:3:4-Triacetoxylavone** (*triacetylalpigénin*) (CZAJKOWSKI, V. KOSTANECKI, and TAMBOR), A., i, 504.
- 1:2:4-Triacetoxy- α - and β -naphthalenes** (THIELE and WINTER), A., i, 505.
- Triacetoxystyrogallol** (SLAMA), A., i, 177.
- 2:4:5-Triacetoxytoluene** (THIELE and WINTER), A., i, 505.
- Triacetoxy**. See also under Parent Substance.
- 7-Triacetylerythrose** (WOHL), A., i, 140.
- Triacetyljapaconitine** (DUNSTAN and READ), T., 54; P., 1899, 207.
- Triacetyl**-. See also under Parent Substance.
- Trianiline antimoniochloride** (HIGBEE), A., i, 285.
- Trianilinomethylhydrazine** and its derivatives (BUSCH), A., i, 27; (BUSCH and BAUER), A., i, 414.
- Triasines** from *o*-aminoazo-compounds (BUSCH and HARTMANN), A., i, 59.
- 1:2:3-Triazole** and its 4-mono- and 4:5-di-carboxylic acid (ZINCKE, STOFFEL, and PETERMANN), A., i, 526.
- 1:2:4-Triazole** and its hydrochloride, nitrate and salts (HANTZSCH and SILBERRAD), A., i, 263.
- Triazole derivatives**, conversion of tetrazine derivatives into (HANTZSCH and SILBERRAD), A., i, 263; (BUSCH and HEINRICHS), A., i, 314.
- 1:2:4-Tribenzoxyanthraquinone**, its halogen derivatives (SLAMA), A., i, 182.
- Tribenzoxy**-. See also under Parent Substance.
- Tribenzylamine hydrochloride**, *p*-tricyano- (MOSES), A., i, 659.
- Tribenzylhydrazine**, *o*-trinitro- (BUSCH and WEISS), A., i, 699.
- Triethylamine oxide**, Bewad's (LACHMAN), A., i, 380.
- Triethylamine tin bromides** (COOK), A., i, 142.
- 1:3:4-Triethylbenzene**. See ψ -Cumene.

- Triethylenediaminechromium haloids, chromates, nitrate, sulphate, and cobaltochloride (PREIFFER), A., i, 560.
- Triethylenediaminenickel chloride (KURNAKOFF), A., i, 209.
- Triethylhydroxylammonium iodide (LACHMAN), A., i, 380.
- Triethylmethane. See Heptane.
- Triethylphosphine, action of, on ω -dibromo-*o*-xylene (PARTHEIL and GRONOVER), A., i, 368.
- Triethylsulphine iodide mercuric iodide (SMILES), T., 162; P., 1899, 240.
- 2:3:6-Trihydroxyanthracoumarin. See Hydroxystyrogallol.
- 1:2:3-Trihydroxyanthraquinone. See Anthragallol.
- Trihydroxybenzaldehyde pentacetate (THIELE and WINTER), A., i, 501.
- 2:3:4-Trihydroxybenzoic acid, thermochemistry of (MASSOL), A., i, 499.
- Trihydroxybutyric acid. See *d*-Erythronic acid.
- 1:3:4-Trihydroxyflavone. See Apigenin.
- 2:3:4-Trihydroxyflavone and its diacetyl derivative (V. KOSTANECKI and SOCHMIDT), A., i, 238.
- 1-Trihydroxyglutaric acid, compound of, with formaldehyde (ALBERDA VAN EKENSTEIN and DE BRUYN), A., i, 619.
- 1:2:4-Trihydroxynaphthalene and its triacetyl derivative (THIELE and WINTER), A., i, 505.
- Trihydroxy- β -naphthaquinone (THIELE and WINTER), A., i, 505.
- 1:2:4-Trihydroxy- α -naphthaquinone (naphthapurpurin) from naphthazarin (JAUBERT), A., i, 42.
- Trihydroxytoluene and its triacetyl derivative (THIELE and WINTER), A., i, 505.
- Triketosantonin acid and its dioxime (FRANCESCOINI), A., i, 101.
- 1:3:4-Trimethoxyflavone (CZAJKOWSKI, V. KOSTANECKI, and TAMBOR), A., i, 504.
- 1:5:8-Trimethoxyphenanthrene (PACHORR), A., i, 234.
- Trimethylallylene. See Hexinene.
- Trimethylamine from methylmorphimethine (PARTHIEL and GRONOVER), A., i, 516.
- cadmium haloids (RAGLAND), A., i, 141.
- tellurium bromide (LENHER), A., i, 379.
- tin haloids (COOK), A., i, 142.
- 2:4:6-Trimethylbenzamide, alkali salt of, and compound of, with potassium hydroxide (WHEELER), A., i, 492.
- 1:2:5-Trimethylbenzene. See Mesitylene.
- 2:3:4-Trimethylbenzoic acid (*prehnitic acid*) (LAPWORTH and CHAPMAN), T., 311; P., 1900, 4.
- 2:4:5-Trimethylbenzyl-hydrazine, and semicarbazide and their derivatives (CURTIUS), A., i, 612.
- Trimethylbrasilin, oxidation of, with potassium permanganate (GILBODY, PERKIN, and YATES), P., 1900, 105.
- $\alpha\beta\beta$ -Trimethylbutane- $\alpha\alpha\alpha$ -tricarboxylic acid (NOYES), A., i, 202.
- $\alpha\beta\beta$ -Trimethylbutyric acid, γ -cyano-, ethyl ester (THORPE and YOUNG), T., 939; P., 1900, 115.
- Trimethylcoumarones, isomeric (STOERMER), A., i, 652.
- 2:4:6-Trimethyldihydropyridinedicarboxylic acid, ethyl ester, action of heat on (GUARESCHI and GRANDE), A., i, 112.
- Trimethyldihydropyridone, cyano-, action of heat on (GUARESCHI and GRANDE), A., i, 112.
- 4:4:6-Trimethyldihydropyrimidine, 2-amino-, and its derivatives (TRAUBE and SCHWARZ), A., i, 116.
- Trimethyldihydroresorcylic acid, ethyl ester and Trimethyldihydroresorcinal and its ethyl ether and bromo-derivatives (CROSSLEY), P., 1900, 90.
- Trimethyldihydroxybenzenes (COLLIER and STEELE), T., 961; P., 1900, 146.
- Trimethylene (cyclopropane), influence of hydrobromic acid on the rate of action of bromine on (GUSTAVSON), A., i, 535.
- derivatives, synthesis of (GUARESCHI and GRANDE), A., i, 111; (MINOZZI), A., i, 406.
- bromide, action of zinc dust on (WOLKOFF and MENSCHUTKIN), A., i, 423.
- trans*-Trimethylenedicarboxylic acid, formation of (HOWTELL and PERKIN), P., 1899, 242.
- Trimethylenedisulphone, action of formaldehyde on (KÖRTZ), A., i, 370.
- Trimethylenepieryl acetate (V. PRICHMANN), A., i, 513.
- 1:3:3-Trimethyl-2-ethylidenindoline and its hydriodide (PLANCHER), A., i, 561.
- $\alpha\beta\beta$ -Trimethylglutaric acid (*hexanedicarboxylic acid*) (CROSSLEY), P., 1900, 91.
- 2:4:5-Trimethylhippuric acid (*dwylicric acid*) (RÜGHEIMER and FEHLHAER), A., i, 610.
- Trimethylhydrindamine iodide, preparation of, and indene from (KIPPING and HALL), T., 469; P., 1900, 54.
- 2:3:3-Trimethylcyclopentanone (NOYES), A., i, 202.

- Trimethylphloroglucinol** and its tri-bromo- and triacetyl-derivatives (HERZIG, POLLAK, and ROHM), A., i, 595.
- Trimethylpropylmethane.** See Heptane.
- 4:5:6-Trimethyl-pyridone and -pyridine** and its salts (GUARESCHI), A., i, 558.
- Trimethylpyrone** (COLLIE and STEELE), T., 961; P., 1900, 146.
- 5:6:8-Trimethylquinoline**, additive compounds and tetrahydride of (WIKANDER), A., i, 310.
- Trimethylsulphine salts** (STRÖMHOLM), A., i, 325.
- iodide mercuric iodide (SMILES), T., 161; P., 1899, 240.
- "Trinaphthylguanidine, cyano-"** (MEVES), A., i, 484.
- Trional**, chemico-toxicology of (VITALI), A., ii, 774.
- Triphenylbenzene** (AMEYE), A., i, 35.
- synthesis of, from acetophenone (DELACRE), A., i, 603.
- from dyphone (GRSCHKE), A., i, 604.
- Triphenylcarbinol**, attempts to prepare ethers of (LANDER), T., 732.
- Triphenylcrotonolactone** (*triphenylbutenolide*) (KLOBB), A., i, 406.
- Triphenyldecahydroacridinedione** (VORLÄNDER and STRAUSS), A., i, 100.
- β -Triphenylguanidine**, preparation of (V. BRAUN), A., i, 643.
- "Triphenylguanidine, cyano-"** (MEVES), A., i, 483.
- Triphenylmethane**, hydrogenised derivatives of (VORLÄNDER), A., i, 99.
- Triphenylmethane dyes**, salts and bases of (HANTZSCH and OSWALD), A., i, 256; (HANTZSCH), A., i, 365.
- Triphenyloctahydro-xanthenedione** (*"benzylidenephenyldihydroresorcinol"*) (VORLÄNDER and STRAUSS), A., i, 100.
- 1:3:5-Triphenylpyrazole** (WISLICENUS), A., i, 38.
- 333-Triphenylsemicarbaside**, and its acetyl and benzylidene derivatives (RUPE and LABHARDT), A., i, 250.
- Triphenyltetrasoliumhydroxide-I-m-sulphonie acid**, inner anhydride of (FICHTER and SCHIESS), A., i, 366.
- Tripropylamine oxide**, action of heat on (MAMLOCK and WOLFFENSTEIN), A., i, 209.
- Tripropylenediaminechromium iodide** (PFEIFFER), A., i, 560.
- Tripyridinechromium trichloride** (PFEIFFER), A., i, 559.
- additive compounds of, with nitriles (PFEIFFER), A., i, 688.
- Trisbisdiamomethanetetra-carboxylic acid** (HANTZSCH and SILBERRAD), A., i, 262.
- Triadihydroxybenzoylenebenzene**, and its hexabenzoyl derivative (LANDAU), A., i, 667.
- Trisdiketohydrindene** (LIEBERMANN and FLATOW), A., i, 667.
- Tri-p-tolylglyoxaline.** See *p*-Toluidine.
- Tropine**, formation of, from tropinone (WILLSTÄTTER and IGLAUER), A., i, 404.
- action of potassium permanganate on (WILLSTÄTTER), A., i, 404.
- separation of, from ψ -tropine (WILLSTÄTTER and IGLAUER), A., i, 404.
- Tropine nucleus**, optical properties of (PICCININI), A., i, 249.
- Tropinone**, formation of (WILLSTÄTTER), A., i, 404.
- and its acetyl derivative and semicarbazone (WILLSTÄTTER and IGLAUER), A., i, 244; (WILLSTÄTTER and BODE), A., i, 245.
- reduction of, to tropine and tropan (WILLSTÄTTER and IGLAUER), A., i, 404.
- alkali salts (WILLSTÄTTER and BODE), A., i, 245.
- l*-Tropinone** (WILLSTÄTTER and BODE), A., i, 245.
- Tropon.** See Agricultural Chemistry.
- Tumours**, amyloid, in the upper air passages (MANASSE), A., ii, 295.
- Tungsten** (SMITH), A., ii, 80.
- atomic weight of (SMITH and HARDIN), A., ii, 80.
- preparation of pure (DELÉPINE), A., ii, 548.
- preparation of, by the aid of liquid air (STAVENHAGEN), A., ii, 80.
- heat of oxidation of (DELÉPINE and HALLOPEAU), A., ii, 8; (DELÉPINE), A., ii, 548.
- Tungsten compounds**, analysis of (IBBOTSON and BREARLEY), A., ii, 317.
- Tungsten trioxide** (*tungstic anhydride*), action of sulphur chloride on (SMITH and FLECK), A., ii, 81.
- reduction of, by metals (DELÉPINE and HALLOPEAU), A., ii, 8; (DELÉPINE), A., ii, 548.
- Tungstic acids**, complex (KEHRMANN and RÜTTIMANN), A., ii, 145.
- Paratungstates** (HALLOPEAU), A., ii, 350.
- Tungsten diphosphide and iron phosphide** (DEFAQZ), A., ii, 350.
- Tungsten organic compounds:**—
- alkyls (SMITH, BARNETT, and HALL), A., i, 89.
- Tungstic acid**, esters of (SMITH and DUGAN), A., i, 76.

- Tungsten**, separation of, from molybdenum (IBBOTSON and BREARLEY), A., ii, 445.
- Tungsten-lithium bronze** (STAVENHAGEN), A., ii, 80.
- Tungsten ores and residues**, rapid assay of (BORNTÄGER), A., ii, 692.
- Tungsten powders**, metallic, evaluation of (IBBOTSON and BREARLEY), A., ii, 316.
- Tungsten-steel**, analysis of (M'KENNA), A., ii, 765.
- estimation of phosphorus in (IBBOTSON and BREARLEY), A., ii, 757.
- Turgite** from Moravia (KOVÁŘ), A., ii, 148.
- Turpentine oil** (TYRER and WERTHEIMER), A., i, 676.
- autoxidation of (ENGLER), A., i, 399.
- Turpeth resin**, examination of (DIETERRICH), A., ii, 118.
- Turquoise** from New Mexico (PETERSEN), A., ii, 661.
- Tyrosinase**, action of, on tyrosine (GESSARD), A., i, 468.
- Tyrosine** from proteids (REACH), A., i, 126.
- colour test for (DENIGES), A., ii, 378.
- test for, in well waters (CAUSSE), A., ii, 458.
- Tyrosines** (FISCHER), A., i, 172.

U.

- Ulva latissima* (sea-weed), and its relation to the pollution of sea water by sewage (LETTS and HAWTHORN), A., ii, 747.
- Undecanoic acid**, and its oxidation (THOMS), A., i, 622.
- Unsaturated groups** of atoms, negative nature of (HENRICH), A., i, 429.
- Uracil**, amino-, and its acyl and metallic derivatives and salts (BEHREND and GRÜNWARD), A., i, 63.
- Uranium**, preparation of, by the acid of liquid air (STAVENHAGEN), A., ii, 80.
- radiation from (BECQUEREL), A., ii, 518.
- radio-activity of (CROOKES), A., ii, 586.
- Uranium compounds**, rays from (CURIE), A., ii, 81; (P. and S. CURIE; P. and S. CURIE and BÉMONT), A., ii, 82.
- Uranium trioxide**, compounds of, with sulphurous acid (KOHLSCHÜTTER), A., ii, 484.
- oxides, preparation of some (ALOV), A., ii, 484.
- Uranium ores** from West Colorado (HILLEBRAND and RANSOME), A., ii, 599.
- radio-active substances from (GIESEL), A., ii, 19.
- Uranyl salts**, constitution of (LEY), A., ii, 67, 731.
- fluoride, compounds of, with sodium and with potassium fluoride and the action of hydrogen peroxide on them (LORDKIPANIDŽE), A., ii, 658.
- Urea** (carbamide), amount of, in the liver (GOTTLIEB), A., ii, 29.
- in human milk (SCHÖNDORFF), A., ii, 556.
- estimation of, by the hypobromite method, influence of dextrose on (GARNIER and MICHEL), A., ii, 699.
- estimation of, in tissues (GOTTLIEB), A., ii, 57.
- estimation of, in urine (JOLLES), A., ii, 515.
- separation of purine derivatives from (KÜGGER and SCHMIDT), A., ii, 31.
- See also Carbamide.
- Ureides**, a quantitative reaction of (JOLLES), A., ii, 454, 636.
- Urethanes**, substituted, nitroso- (HANTZSCHER), A., i, 86.
- Uric acid**, formation and decomposition of, in the organism (WIENER), A., ii, 153.
- formation of, after splenectomy (MENDEL and JACKSON), A., ii, 607.
- deposits of, artificially produced in hens (SCHREIBER and ZAUDY), A., ii, 292.
- action of iodine solution and of permanganate on (JOLLES), A., ii, 322.
- solubility of, in nucleic and thymic acids (KOSSEL and GOTO), A., ii, 421; (GOTO), A., ii, 740.
- and its salts, behaviour and reactions of, in solution (HIS and PAUL), A., i, 591.
- salts of (TUNNICLIFFE and ROSENHEIM), A., i, 636.
- precipitation of, by barium chloride, from urine (JOLLES), A., ii, 696.
- estimation of, in blood and animal organs (HIS and HAGEN), A., ii, 769.
- estimation of, in urine (WÖRNER), A., ii, 251; (JOLLES), A., ii, 450; (BELLOCQ), A., ii, 695.
- Uric acid series**, thermal effect of oxidation and methylation in the (BERTHELOT), A., ii, 189.
- Urinary calculi**, composition of (SPIEGEL), A., ii, 422.
- secretion, influence of peptones and albumoses on (THOMPSON), A., ii, 226.

Urine, investigation of, by the freezing point and blood corpuscle method combined (HAMBURGER), A., ii, 421.
 cryoscopy of, in diagnosis and prognosis (CLAUDE and BALTHAZARD), A., ii, 154.
 relation of the reducing power of normal, to the amount of certain nitrogen compounds in (LONG), A., ii, 580.
 absorption of free oxygen by normal (BERTHELOT), A., ii, 740.
 oxidation of (COTTON), A., ii, 293.
 influence of caffeine on the output of alkalis in the (KATSUYAMA, KUWAHARA, and SENO), A., ii, 94.
 action of tannin on (GARNIER and MICHEL), A., ii, 58.
 glycolytic action of the (PIERALLINI), A., ii, 420.
 toxicity of (CHARRIN), A., ii, 559.
 of vegetarians, peculiarities in the (LONG), A., ii, 674.
 volume of, eliminated, dependent on quantity and concentration of sugars injected (HÉDON and ARROUS), A., ii, 94.
 acetone in (LÜTHJE), A., ii, 229.
 albumin in normal (BELLOCQ), A., ii, 556.
 occurrence of Bence-Jones albumin in (MAGNUS-LEVY), A., i, 615.
 in nephritis, alloxuric substances in (MARTIN), A., ii, 155.
 r-arabinose in (NEUBERG), A., i, 539.
 elimination of sodium cacodylate in, after ingestion (IMBERT and BADEL), A., ii, 293.
 excretion of calcium oxalate in (PIERALLINI), A., ii, 492.
 elimination of carbohydrates in (ROSENFELD), A., ii, 358.
 glycuronic acid in normal (MAYER), A., ii, 155; (MAYER and NEUBERG), A., ii, 421.
 hydroxybutyric acid in diabetic (MAGNUS-LEVY), A., ii, 155.
 indigotin in, after administration of oxalates (HARNACK and V. D. LEYEN), A., ii, 422.
 nitrogen, phosphates, and sulphates in, after ingestion of proteid food (SHERMAN and HAWK), A., ii, 421.
 oxaluric acid in (SALKOWSKI), A., ii, 635.
 isolation of pentose and methylpentose from (BERGELL and BLUMENTHAL), A., ii, 373.
 organic phosphorus compounds in infants (KELLER), A., ii, 293.
 loosely combined sulphur in (PETRY), A., ii, 675.

Urine, sulphur in, after extirpation of the liver (LANG), A., ii, 556.
Urine, analytical processes relating to:—
 diazo reactions of (BRIEGER), A., i, 316; (CLEMENS), A., ii, 227.
 preparation of Ehrlich's diazo-reagent (WESENBERG), A., ii, 776.
 detection of acetic acid and bilirubin in (ARNOLD), A., ii, 113.
 detection of acetone in (OFFENHEIMER), A., ii, 180.
 detection of acetoacetic acid in pathological (ARNOLD), A., ii, 768.
 detection of albumin in (MANKIEWICZ), A., ii, 459; (JOLLES), A., ii, 516.
 detection of albumoses in (v. ALDOR), A., ii, 123.
 biological detection of arsenic in (SCHOLTZ), A., ii, 244.
 detection of bile pigments in (HAMMARSTEN), A., ii, 637.
 detection of glycuronic acid in (MAYER), A., ii, 155.
 detection of indican in pathological (KLETT), A., ii, 776.
 detection of mercury in (HOEHNEL), A., ii, 368; (JOLLES), A., ii, 576.
 detection of phenetidine in (EDLEFSEN), A., ii, 378.
 source of error in the detection of sugar in, by means of Fehling's solution (EURY), A., ii, 249.
 detection of sugar in, by phenylhydrazine (KOWARSKY), A., ii, 54.
 simplification of the phenylhydrazine test for sugar in (NEUMANN), A., ii, 248.
 effect of glycuronic acid on the phenylhydrazine test for sugar in (MAYER), A., ii, 320.
 detection of nrobin in (ROMAN and DELLUC), A., ii, 700.
 detection of urochloralic acid in, after administration of chloral hydrate (VITALI), A., ii, 115.
 estimation of acetoacetic acid in (ARNOLD), A., ii, 768.
 estimation of acetone, acetoacetic and acetonedicarboxylic acids in (SABBATANI), A., ii, 32.
 estimation of the acidity of (BERTHELOT; NÄGELI), A., ii, 741.
 error in estimating albumin in (DE-ROIDE and OUI), A., ii, 123.
 estimation of allantoin in (LOEWI; PODUSCHKA), A., ii, 636.
 estimation of indican in (WANG), A., ii, 122; (BOUMA), A., ii, 700.
 estimation of mercury in (SCHUMACHER and JUNG), A., ii, 247; (JOLLES), A., ii, 576; (FARUP; WERDER), A., ii, 689.

Urine, analytical processes relating to:—

- clinical estimation of mercury in (ESCHRAUM), A., ii, 368.
- estimation of amino-acid nitrogen in (PFAUNDLER), A., ii, 674.
- estimation of oxalic acid in (SALKOWSKI), A., ii, 635.
- estimation of pentoses in (SULEYMAN BEY), A., ii, 446.
- estimation of the reducing power of (ROSIN), A., ii, 319; (SPIEGEL and PERITZ), A., ii, 457.
- estimation of reducing substances in, by Peške's method (GREGOR), A., ii, 94.
- estimation of sugars in (NEUBERG), A., i, 410; (PELLET), A., ii, 113.
- estimation of sugar in diabetic (PATEIN and DUFAY), A., ii, 176; (TROEGER and MEINE), A., ii, 635.
- estimation of urea in (JOLLES), A., ii, 515.
- estimation of uric acid in (WÖRNER), A., ii, 251; (JOLLES), A., ii, 450; (BELLOCQ), A., ii, 695.
- precipitation of uric acid from, by barium chloride (JOLLES), A., ii, 696.

Urinometer (BENOIT), A., ii, 435.

Urobilin, detection of, in urine (ROMAN and DELLUC), A., ii, 700.

Urochloralic acid, detection of, in urine after administration of chloral hydrate (VITALI), A., ii, 115.

Urotropine. See Hexamethylenetetramine.

Uranic acid (WIDMAN), A., i, 347.

constitution of (PATERNO), A., i, 662.
optical isomerides and oximes of (WIDMAN), A., i, 235.

Usonic acid (WIDMAN), A., i, 348.

Utensils, plated copper, estimation of silver on (GIRARD), A., ii, 170.

V.

Valencies, partial, theory of (KNOEVENAGEL; THIELE), A., ii, 534.

Valeraldehyde, physiological action of (ELFSTRAND), A., ii, 423.

Valeric acid, rotatory power of active (GUYE and ASTON), A., ii, 253.
separation of, from butyric and lactic acids (SCHNEIDER), A., ii, 177.

d-**Valeric acid** (*methyl-2-butyric acid*), methyl ester and amide of, and solubility of its silver salt (TAVERNE), A., i, 472.

iso-**Valeric acid**, α -thiocyano-, esters, formation and boiling points of (WHEELER and BARNES), A., i, 565.

Valeric acids (α - and β -*methylbutyric acids*), γ -cyano-, ethyl esters (HOWLES, THORPE, and UDALL), T., 947; P., 1900, 116.

γ -**Valerolactone**-*By-dicarboxylic acid* and its diethyl ester (BRETT and KERSHAW), A., i, 136.

Vanadium in plants (DEMARÇAY), A., ii, 235.

in rocks (VOGT), A., ii, 150.

spectrum of (HÄNNELBERG), A., ii, 381.

Vanadic oxide, preparation of pure, from iron ores (POPE), A., ii, 409.

Vanadiomolybdates and Silicovanadiomolybdates (FRIEDHEIM and CASTENDYCK), A., ii, 483.

Vanadium, estimation of, colorimetrically (MAILLARD), A., ii, 577.

estimation of, in iron ores (POPE), A., ii, 409.

separation of, from sulphuric acid (GOYDER), T., 1096.

Vanadium ores from West Colorado (HILLEBRAND and RANSOME), A., ii, 599.

Vanillin, presence of, in vanilla (BEHRENS), A., ii, 679.

in vinegar-essences (FROBENIUS), A., i, 603.

in wine vinegar (STOCKÝ), A., ii, 454.

formation of, in potato parings and its detection (BRÄUTIGAM), A., ii, 427.

action of nitric acid on (BENTLEY), A., i, 552.

estimation of (WELMANS), A., ii, 327; (HANUŠ), A., ii, 773.

Vanillin, *o*-nitro-, acetyl derivative and methyl ether of (PSCHORR and SUMULEANU), A., i, 178.

Vapour density of acetylacetone metallic salts (GACI), A., i, 276.

of bromine at high temperatures (PERMAN and ATKINSON), A., ii, 398.

of dried mercury and of dried mercurous chloride (BAKER), T., 646; P., 1900, 68.

of sulphur (BLEIER and KOHN), A., ii, 203, 721; (SCHALL), A., ii, 271.

See also Density.

Vapour pressure, theory of (GAHL), A., ii, 389.

diminution of, of dilute solutions (SMITS), A., ii, 708.

determination of, under arbitrary pressure (BLEIER and KOHN), A., ii, 192.

determination of the decrease in, by means of the determination of the increase in boiling point (SMITS), A., ii, 389.

Vapour pressure of the solvent (PONSOT), A., ii, 337.
 of mercury (HULETT), A., ii, 543.
 relations of mixtures of acetone and water (TAYLOR), A., ii, 529.
 of a series of benzene compounds (WORINGER), A., ii, 709.
 of camphor (ALLEN), T., 413; P., 1899, 135.
 of diisopropyl and diisobutyl (YOUNG and FORTEY), T., 1126; P., 1900, 165.
 of naphthalene (ALLEN), T., 400; P., 1899, 122.
 of *n*-octane (YOUNG), T., 1145; P., 1900, 166.
Vapour tension. See Vapour pressure.
Vegetables. See Agricultural Chemistry.
Velocity of chemical change. See Affinity.
Veratric acid, nitro- and amino-, constitution of (PSCHORR and SUMULEANU), A., i, 178.
Veratrine, action of chloroform or ether on (SCHAEER), A., ii, 455.
 action of, on muscle and nerve (WALLER), A., ii, 425.
Verberna, oil of, aldehydic constituents of (KERSCHBAUM), A., i, 353.
Verbenone (KERSCHBAUM), A., i, 353.
Vetoes. See Agricultural Chemistry.
Vicia seeds, hydrocyanic acid in (BRUYNING and VAN HAARST), A., ii, 160.
Vine. See Agricultural Chemistry.
Vinegar, fermentation, detection of aldehyde in (BÜTTINGER), A., ii, 778.
 wine, vanillin in (STOCKY), A., ii, 454.
 estimation of acetic acid in (DURIEU), A., ii, 322.
 See also Cider vinegar.
Vinegar-essences, vanillin in (FROBENIUS), A., i, 603.
Vinylacetic acid (FICHTER and KRAFFT), A., i, 8.
Vinylidene-oxanilide, -oxalotoluidides, and -oxaloxylylide (v. PECHMANN and ANSEL), A., i, 287, 389.
Vinyl nitrate, triiodo-. See Ethylene, triiodonitro-.
Vinylthioethylenethioglycollic acid and its salts (STRÖMHOLM), A., i, 13.
Violuric acid. See Barbituric acid, nitroso-.
Viscosity (*internal friction*) and electrolytic conductivity in saline solutions (MASSOULIER), A., ii, 331.
 and velocity of solidification of supercooled liquids (WILSON), A., ii, 712.
 of argon as affected by temperature (RAYLEIGH), A., ii, 590.

Viscosity (*internal friction*) of essential oils (DOWZARD), A., i, 676.
 of sulphur (MALUS), A., ii, 536.
 of water and solutions of sodium chloride, and of sucrose (HOSKING), A., ii, 336.
Vision, action of amyl nitrite and santonin on (FILEHNE), A., ii, 424.
Vitalism and asymmetry (ULPIANI and CONDELLI), A., ii, 463.
Vitellin, compounds of, in egg-yolk (OSBORNE and CAMPBELL), A., i, 616.
Vitexin, constitution of (PERKIN), T., 422; P., 1900, 45.
Vivianite from Moravia (KOVÁR), A., ii, 148.
Volume, atomic, and magnetic susceptibility of elements, connection between (MEYER), A., ii, 8.
 molecular, absolute (GULDBERG), A., ii, 264; (BERTHELOT), A., ii, 335.
 of camphor derivatives (HALLER and MÜLLER), A., ii, 193.
 specific, of diisopropyl and diisobutyl (YOUNG and FORTEY), T., 1126; P., 1900, 165.
 of *n*-octane (YOUNG), T., 1145; P., 1900, 166.
Von-Diestite from Colorado (CUMENGE), A., ii, 660.

W.

Wallflower, active constituents of (KEEB), A., i, 186.
WATER:—
 spectrum of the vapour of (TROWBRIDGE), A., ii, 701.
 conductivity of, distilled in air (WALKER and CORMACK), T., 11.
 heat of dissociation of (ABEGG), A., ii, 190.
 vapour pressure relations of acetone and (TAYLOR), A., ii, 529.
 minimum in the molecular lowering of the freezing point of, produced by acids and salts (CHAMBERS and FRAZER), A., ii, 526.
 freezing point curve for, containing hydrogen chloride and phenol (EMERY and CAMERON), A., ii, 335.
 freezing point of mixtures of acetic acid and (DE COPPET), A., ii, 65.
 compressibility of (HULETT), A., ii, 398.
 viscosity of (HOSKING), A., ii, 336.
 equilibrium between acetone, phenol and (SCHREINEMAKERS), A., ii, 393.
 equilibrium between alcohol, an alkali salt and (DE BRUYN), A., ii, 266.

WATER:—

equilibrium between alcohol, gelatin and; and agar and (HARDY), A., ii, 396.

equilibrium between aniline, phenol and (SCHREINEMAKERS), A., ii, 135.

equilibrium between hydrochloric acid, phenol and (KRUG and CAMERON), A., ii, 393.

equilibrium between phenol, *d*-tartaric or racemic acid, and (SCHREINEMAKERS), A., ii, 393.

absorption and emission of the vapour of, by colloids (DUHEM), A., ii, 338.

decomposition of, by fluorine (MOISSAN), A., ii, 13.

action of metallic magnesium on (BRYANT), A., ii, 278.

reactions in (ROHLAND), A., ii, 468.

Water of crystallisation (SALZER), A., ii, 270.

nature of (RINKE), A., ii, 202.

in the barium and calcium salts of γ -methylvaleric acid (ORNSTEIN), A., i, 7.

NATURAL WATER:—

purification of (TIXIER), A., ii, 71.

apparatus for the distillation of (MAREK), A., ii, 202.

Rain-water collected at Cirencester, amount of chlorine in (KINCH), T., 1271; P., 1900, 183.

Glacial waters from Norway (HOLLAND and DICKSON), A., ii, 151.

Lake water of the Salt Lake of Urmia, Persia (GÜNTHER and MANLEY), A., ii, 220.

Spring and mineral waters of Australasia (LIVERSIDGE, SKEY, and GREY), A., ii, 288.

hot sulphur, from Deutsch-Altenburg (LUDWIG and PANZER), A., ii, 90.

from the Cold or "Park" spring at Evaux-les-Bains (BONJEAN), A., ii, 488.

French, composition of (CARNOT), A., ii, 552.

from Graubünden, Switzerland (NUSSBERGER), A., ii, 90.

from Jouhe, near Dôle, Jura (BOURCET), A., ii, 355.

from Lutraki, Greece (DAMBERGIS), A., ii, 90.

of Monsummano (ALBERTONI and CORONEDI), A., ii, 90.

of Mont-Dore, gases from the (PARMENTIER and HURION), A., ii, 415.

from the Brault No. 3 spring at Sail-sous-Couzan (BONJEAN), A., ii, 488.

NATURAL WATER:—

Spring and mineral waters of Salsomaggiore (NASINI and ANDERLINI), A., ii, 489.

combustible gases from the (NASINI and SALVADORI), A., ii, 415.

of Spain and Portugal, fluorine in (FERREIRA DA SILVA and D'AGUIAR), A., ii, 28.

apparatus for the estimation of carbon dioxide in (HELD), A., ii, 169.

estimation of silica in, colorimetrically (SALVADORI and PELLINI), A., ii, 367.

Sea water, composition of, and evaporation of, at 25° (VAN'T HOFF and MEYERHOFFER), A., ii, 23.

influence of temperature and pressure on the evaporation of (VAN'T HOFF and DAWSON), A., ii, 76.

calcium carbonate in (COHEN and RAKEN), A., ii, 725.

poisonous action of, on plants (COUPIN), A., ii, 236.

examination of, optically (MANLEY), A., ii, 619.

estimation of dissolved oxygen in (LETTS and BLAKE), A., ii, 755.

Well waters, connection between chlorides, nitrates and sulphates in (KÖNIG), A., ii, 438.

impure, cystin and tyrosine in (CAUSSE), A., ii, 457, 458.

Water analysis:—

detection of nitric acid in (UTZ), A., ii, 438.

detection of nitrous acid in (ERDMANN), A., ii, 243; (SPIEGEL), A., ii, 318; (MENNICKE), A., ii, 438, 621; (SCHAER), A., ii, 438.

estimation of ammonia and nitrogen in, apparatus for (WESTON), A., ii, 685.

estimation of the hardness of (VENTUROLI), A., ii, 579.

estimation of nitric acid in (HÖNIG), A., ii, 242.

estimation of nitrous acid in (ROMIJN), A., ii, 510.

estimation of dissolved oxygen in (MUTSCHLER), A., ii, 106; (ZETSCHKE), A., ii, 166; (LETTS and BLAKE), A., ii, 755.

Wax of Bacillariaceæ (KRAEMER and SPILKER), A., i, 73.

bees', detection and estimation of impurities in (FUNARO), A., ii, 55.

Japan, constituents of (GEITEL and VAN DER WANT), A., i, 271.

(*o*-Xylene, *Me:Me*=1:2; *m*-xylene, *Me:Me*=1:3; *p*-xylene, *Me:Me*=1:4.)

Waxes, acetyl value of (LEWKOWITSCH), A., ii, 323.

Weight, molecular, by the boiling point method, apparatus for determining (McCoy), A., ii, 387.

drop methods for the determination of (ROSSET), A., ii, 336.

of gases, determination of, from their density (VAN DER WAALS), A., ii, 134.

of liquids and van't Hoff's equation (SPEYERS), A., ii, 10.

of iodine and its *mono*- and *tri*-chlorides and of phosphorus *pentachloride*, in various solvents (ODDO and SERRA), A., ii, 73.

of ozone (LADENBURG), A., ii, 721.

of phosphoryl bromides and chlorides, of sulphur chlorides, and of chromyl dichloride in various solvents (ODDO and SERRA), A., ii, 75.

of sulphur (BLEIER and KOHN), A., ii, 203, 721; (ARONSTEIN and MEIHZEN), A., ii, 341.

of the aldols (KOHN), A., i, 274.

of starch (RODEWALD and KATTEIN), A., i, 477.

Weights, method of testing (RICHARDS), A., ii, 534.

"**Weissmetall**," analysis of (NISSENSON), A., ii, 108.

Westanite from Westanå, Sweden (WEIBULL), A., ii, 286.

Wheat, oil from (FRANKFORTER and HARDING), A., ii, 37.

See also *Agricultural Chemistry*.

Willow bark, new glucoside from (JOWETT), T., 707; P., 1900, 89.

Wines, chemistry and analysis of (RIPPER), A., ii, 319.

marc, recognition of (FRESENIUS and GRÜNHUT), A., ii, 52.

addition of phenolphthalein to (V. VÁMOSSY), A., ii, 876.

detection of fluorine in (PARIS), A., ii, 572.

detection of "saccharin" in (VITALI), A., ii, 57.

cause of error in testing for salicylic acid in (FERREIRA DA SILVA), A., ii, 695.

estimation of potassium hydrogen tartrate in (MAGNIER DE LA SOURCE), A., ii, 768.

estimation of sugars in, polarimetrically (PELLET), A., ii, 113; (ROCQUES), A., ii, 695.

Wood (*Isatis tinctoria*), formation of indigotin from (BEYERINCK), A., i, 230, 480, 649.

Wool, specific heat of (FLEURY), A., ii, 188.

Wool fat, analysis of (BORNTRÄGER), A., ii, 773.

Work, muscular, influence of alcohol on (SCHEFFER), A., ii, 418.

X.

Xanthic acid, potassium salt, preparation of, for nickel estimations (CAMPBELL), A., ii, 577.

Xanthine, new synthesis of (TRAUBE), A., i, 416.

Xanthine bases in feces (PARKER), A., ii, 556.

Paraxanthine, decomposition of, in the organism (KNUßER and SCHMIDT), A., ii, 31.

Xanthone, *mono*- and *di*-thio- (MEYER; MEYER and SZANECKI), A., i, 660.

Xantho-rhamnin and **-rhamnein** (C. and G. TANRET), A., i, 185.

Xylenes, *o*-, *m*-, and *p*-, refraction and magnetic rotation of (PERKIN), T., 267; P., 1899, 237.

density of (v. HIRSCH), A., ii, 9.

***o*-Xylene**, *ω*-, *di*bromo-, action of triethylphosphine on (PARTHEIL and GRONOVER), A., i, 368.

3-iodo- (KLAGES and LIECKE), A., i, 387.

***m*-Xylene**, *as*-iodoso-, *as*-iodoxy-, and *as*-iodonium-compounds of (WILLGERODT and HOWELLS), A., i, 338.

***m*- and *p*-Xylenes**, 2-iodo- (KLAGES and LIECKE), A., i, 387.

***as*-*m*-Xylene** *as*-4-chloro-*m*-phenylene-diamine (COHN and FISCHER), A., i, 458.

Xylenenitroic acid, dinitro-, salts of (HANTZSCH and KISSEL), A., i, 90.

1:2:4-Xylenol, *ω*:2:5:6- and *ω*:3:5:6-tetra-, *ω*:3:5:6-penta-bromo-, and tri-bromo-*ω*-, *di*iodo-, acetyl derivatives; and ethers of (AUWERS), A., i, 96; (AUWERS and v. ERGGELET), A., i, 97. *ω*:*ω*:*ω*:3:4:6-hepta-bromo-, and its acetyl derivatives and ethers (AUWERS), A., i, 96; (AUWERS and BURROWS), A., i, 98.

1:3:4-Xylenol, action of chloroform and alkalis on (AUWERS), A., i, 160.

ω:2:5:6-penta-bromo-, acetyl derivatives of, and their reactions; and 2:5:6-tri-bromo-*ω*-, *di*iodo- (AUWERS; AUWERS and HAMPE), A., i, 96.

methyl ether (AUWERS; AUWERS and HAMPE), A., i, 96.

1:4:3-Xylenol, tri-bromo- (AUWERS and ANSELMINO), A., i, 160.

ω:2:5:6-tetra-bromo- (AUWERS and ANSELMINO), A., i, 160; (AUWERS and BROICHER), A., i, 162.

(*o*-Xylene, *Me:Me*=1:2; *m*-xylene, *Me:Me*=1:3; *p*-xylene, *Me:Me*=1:4.)

- 1:4:5-Xylenol**, ω :2:3:6-pentabromo-, and its acetyl derivative (AUWERS and ANSELMINO), A., i, 160.
- Xylenols**, bromo-derivatives, oxidation products of (AUWERS), A., i, 161; (AUWERS, BROICHER, and WOLFF), A., i, 162.
- Xylenoxy-acetal and -aldehyde hydrate** and its oxime and semicarbazone, *o*- and *m*- (STOERMER), A., i, 652.
- Xylenoxyacetones**, *o*-, *as-m*-, and *p*-, and their oximes (STOERMER), A., i, 652.
- Xylidines**, bromination of, and their acetyl derivatives (FISCHER and WINDAUS), A., i, 484.
isomeric, separation of, from commercial xylidine (HODGKINSON and LIMPACH), T., 65; P., 1899, 202.
- Xyloic lactone** (CLOWES and TOLLENS), A., i, 205.
- Xylose** from tragacanth (WIDTSOR and TOLLENS), A., i, 207.
fermentation of (SALKOWSKI), A., i, 628.
synthesis of *l*-erythritol from (MAQUENNE), A., i, 472.
- l*-Xylose**, phenylbenzylhydrazone of (RUFF and OLLENDORFF), A., i, 77.
- d*- and *l*-Xylose**, from gulonic acid (FISCHER and RUFF), A., i, 539.
- Xylosoxime** (MAQUENNE), A., i, 424, 472.
- m*-Xylylamine** and its derivatives (SOMMER), A., i, 388.
- m*-Xylylcarbamie acid**, ethyl ester, and ***m*-Xylylcarbimide**, and their 5- and 6-nitro-derivatives (VITTENET), A., i, 154.
- p*-Xylylchloroacetylene** (KUNCKELL and GOTSCH), A., i, 639.
- o*-Xylenebisatriethylphosphine** and its salts (PARTHEIL and GRONOVER), A., i, 368.
- m*-Xylylene dibromide** and bromobenzene, action of sodium on a mixture of (PRILEGRIN), A., i, 151.
- Xylylene hydrosulphides**, *o*-, *m*-, and *p*- (KÖTZ), A., i, 343.
- Xylylenemethylenemercaptals**, *o*-, *m*-, and *p*- (KÖTZ), A., i, 343.
- Xylyloxides**, sodium, compounds of, with the ethyl esters of α -bromo-fatty acids (BISCHOFF), A., i, 393.
- α -Xylyloxy-propionic**, ***n*-** and ***iso*-butyric**, and ***isovaleric* acids**, *o*-, *m*-, and *p*-, and their ethyl esters (BISCHOFF), A., i, 393.
- o*-Xylyl-phthaloylic acid** and **-phthalide** (LIMPRICHT), A., i, 599.
- m*-Xylyl-*p*-toluidine**, *o*- and *p*-amino- (COHN and FISCHER), A., i, 690.
- Xylol-2- and -4-trimethylammonium iodides**, *p*- and *m*-, 5- and 6-bromo- (FISCHER and WINDAUS), A., i, 484.

Y.

- Yeast** (BÖTTINGER), A., ii, 33.
reproduction of, without fermentation (ROSENSTIEHL), A., ii, 229.
fermentation of (LINTNER), A., ii, 296.
chemical fermentation by, in an antiseptic medium (DE REY-PAILHADE), A., ii, 678.
formation of enzymes characteristic of (KLÖCKER), A., ii, 743.
physiology of (DUCLAUX), A., ii, 678.
estimation of starch in (BRUYLANTS and DRUYTS), A., ii, 113; (CRISPO), A., ii, 176.
- "Yeast, Chinese,"** and ***Mucor Rouzii*** (WEHMER), A., ii, 743.
- Yeasts**, effect of mineral and nitrogenous nutritive matters on (KUSSEHOW), A., ii, 33.
of "sake" (KOZAI), A., ii, 743.
- Yeast extract** (ALBERT and BUCHNER), A., i, 320, 420.
Buchner's (WRÓBLEWSKI), A., ii, 157.
concentrated (AHRENS), A., ii, 610.
precipitation of (ALBERT and BUCHNER), A., i, 420.
precipitation of zymase from (ALBERT and BUCHNER), A., i, 320.
- Yttrium**, atomic weight of (MUTHMANN and BÖHM), A., ii, 209.
specific gravity of (MEYER), A., ii, 143.
microchemical researches on erbium, didymium and (POZZI-ESCOT and COUQUET), A., ii, 404.
oxide (*yttria*), preparation of pure (MUTHMANN and BÖHM), A., ii, 209.

Z.

- Zinc**, boiling point of (BERTHELOT), A., ii, 654.
solution tension of, in ethyl alcohol (JONES and SMITH), A., ii, 467.
equilibrium between lead and, and mixtures of their fused chlorides (REINDERS), A., ii, 715.
- Zinc alloys** with copper, heat of combination of (BAKER), P., 1899, 195; (GALT), A., ii, 189.
action of, on nitric acid (GLADSTONE), A., ii, 710.
with platinum (HODGKINSON, WARING, and DESBOROUGH), A., ii, 282.
- Zinc borate** (OUVRARD), A., ii, 207.
fluoride, double salts with aluminium or ferric fluoride (WEINLAND and KÖPPEN), A., ii, 143.

Zinc hydroxide, solubility of (HERZ), A., ii, 338.
 equilibrium in the partition of an acid between ammonia and (HERZ), A., ii, 337.
 oxide, behaviour of, at high temperatures (SCHÜPPHAUS), A., ii, 207.
 ammonium phosphate, estimation of zinc in (AUSTIN), A., ii, 49.
 double selenates, crystallography of (TUTTON), A., ii, 593.
 selenide, dimorphism of (FONZES-DIACON), A., ii, 345.
 sulphate, combination of, with ammonia in aqueous solution (DAWSON and McCRAE), T., 1245; P., 1900, 173.
 hydrates of, solubility of (COHEN), A., ii, 184.
 hydroximidosulphate, production of (DRIVERS and HAGA), T., 690; P., 1900, 71.
 potassium sulphate (MALLET), T., 220; P., 1899, 227.
 thioantimonite and its double salt with potassium (POUGET), A., ii, 84.
Zinc organic compounds:—
 alkyls, action of, on alkyl nitrites and on nitroparaffins (BEWAD), A., i, 629.
 ethyl, preparation of (LACHMAN), A., i, 542.
Zinc, estimation of:—
 analysis of, for cadmium and lead (MACKAY), A., ii, 49.

Zinc, estimation of:—
 titration of, with potassium ferrocyanide (MILLER and HALL), A., ii, 688.
 estimation of, volumetrically (MEADE), A., ii, 575.
 estimation of, electrolytically, in presence of manganese (RIEDERER), A., ii, 49.
 estimation of, by solution in hydrochloric acid (BALDY), A., ii, 690.
 estimation of, as phosphate (DAKIN), A., ii, 624.
 estimation of, gravimetrically, as sulphate (EUIER), A., ii, 760.
 technical estimation of, in ores (LOW), A., ii, 441.
 estimation of, in organic substances (LEHMANN), A., ii, 170.
 estimation of, in zinc ammonium phosphate (AUSTIN), A., ii, 49.
Zinc-schefferrite from Franklin furnace, New Jersey (WOLFF), A., ii, 735.
Zingiberene from oil of ginger (v. SODEN and ROJAHN), A., i, 605.
Zinnwaldite (?) from Japan (JIMBÔ), A., ii, 87.
Zirconium, specific gravity of (MEYER), A., ii, 143.
 separation of, from iron (HAVENS and WAY), A., ii, 50.
Zoisite (TERMIER), A., ii, 735.
Zymase, precipitation of, from yeast extract (ALBERT and BUCHNER), A., i, 320, 420.
 condition of, in yeast extract (AHRENS), A., ii, 611.

ERRATA.

VOL. LXXVI. (ABSTR., 1899).

PART I.

Page Line
960 19* for " $C_{13}H_{20}ON_2Br_2, H_2PtCl_6$ " read " $(C_{13}H_{20}ON_2Br_2)_2, H_2PtCl_6$."

VOL. LXXVIII. (ABSTR., 1900).

PART I.

24 16 for "8-nitro-1-nitroso-1-naphthol" read "5-nitro-4-nitroso-1-naphthol."
 ,, 20 ,, "1:3:5:4 or 1:3:8:4" read "2:4:8:1 or 2:4:5:1."
 ,, 15* ,, "1:3:5:4" read "2:4:8:1."
 184 10* ,, "oil of cumin" read "oil of caraway."
 255 14 ,, "2-Nitro-" read "10-Nitro-"
 ,, 14, 15 ,, "2-Amino-" read "10-Amino-"
 ,, 16 ,, "2-nitrophenyl" &c., read "10-nitro-7-phenyl" &c.
 ,, 25 ,, "2-amino-3-dimethylamino-5-"
 read "10-amino-9-dimethylamino-7-"
 ,, 14* ,, "2-amino-3-anilinophenylnaphthaphenazonium-5-"
 read "10-amino-9-anilino-7-phenylnaphthaphenazonium"
 ,, 6* ,, "2-amino-5-phenyl" &c., read "10-amino-7-phenyl" &c.
 443 8*, 4*, 3* }
 444 3, 2* } for "lactone" read "anhydride."
 535 15 for "or Trimethylene" read "on Trimethylene."
 578 17* ,, "TCHERDINTZKEFF" read "TSCHERDINTZEFF."
 686 13* ,, "bromoacetone" read "bromoacetophenone."

PART II.

23 14 for "20" read "1899."
 189 6 ,, "+3HO" read "+3H₂O."
 461 18 ,, "Methyl Acetate" read "Ethyl Ether."
 ,, 28 ,, "ethyl acetate" read "ethyl ether."
 474 13 ,, "60°" read "-60°."
 540 11*, 9* ,, "Hg₆K" read "Hg₆Na."
 ,, 10* ,, "Hg₆K" read "Hg₅Na."
 551 9* ,, "Er₂O" read "Er₂O₃."
 567 24* }
 568 2 } "BARTLET" read "BARTLETT."
 600 24 ,, "D'ACHIARDI" read "D'ACHIARDI."
 657 top ,, "KUZNETZOFF" read "KUTZNETZOFF."
 702 18* ,, "Iaranskite" read "Ioranskite."

* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
I.—The Chlorine Derivatives of Pyridine. Part IV. Constitution of the Tetrachloropyridines. By W. J. SELL, M.A., F.I.C., and F. W. DOOTSON, M.A.	1
II.—The Dissociation Constants of very Weak Acids. By JAMES WALKER and WILLIAM CORMACK	5
III.—The Preparation and Properties of Solid Ammonium Cyanate. By JAMES WALKER and JOHN K. WOOD	21
IV.—Etherification of Derivatives of β -Naphthol. By WILLIAM A. DAVIS	33
V.—Contribution to our Knowledge of the Aconite Alkaloids. Part XV. On Japaconitine and the Alkaloids of Japanese Aconite. By WYNDHAM R. DUNSTAN, F.R.S., and HAROLD M. READ, Assistant Chemist in the Scientific Department of the Imperial Institute	45
VI.—A Method of Separation of the various Isomerides contained in ordinary commercial Xylidine. By W. R. HODGKINSON and LEONHARD LIMPACH	65
VII.—The Oxidation of Organic Acids in Presence of Ferrous Iron. Part I. By HENRY J. HORSTMAN FENTON, M.A., F.R.S., and H. O. JONES, B.A., B.Sc.	69
VIII.—Oxalacetic Acid. By HENRY J. HORSTMAN FENTON, M.A., F.R.S., and H. O. JONES, B.A., B.Sc.	77
IX.—Determination of the Constitution of Fatty Acids. Part II. By ARTHUR WILLIAM CROSSLEY and HENRY RONDEL LE SUEUR	83
X.—Preparation of Benzeneazo- <i>o</i> -nitrophenol. By J. T. HEWITT	99

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

	PAGE
ULLMANN (FRITZ) and IRMA GOLDBERG. Purification of Acetylene . . .	i, 1
AHRENS (FELIX B.). The Heating of, and Evolution of Chlorine from, Bleaching Powder Purifiers for Acetylene . . .	i, 1
NEF (JOHN ULRIC). Tri- and Tetra-halogen substituted Methanes . . .	i, 2
THIRLE (JOHANNES). Solid Butadiene Dibromide . . .	i, 2
IPATIEFF (WLADIMIR) [and in part A. SOLONINA]. Nitrosates . . .	i, 3
SPEERANSKI (N.). Hydrogenation of Allyl alcohol . . .	i, 3
BERTHELOT (MARCELLIN PIERRE EUGENE). Simultaneous Oxidation and Hydration of Organic compounds under the influence of Light and Oxygen . . .	i, 3
NEF (JOHN ULRIC). Dissociation of Alkyl salts of Nitric acid, Sulphuric acid, and the Halogen Hydrides . . .	i, 4
POSNER (THEODOR). Disulphones. III. Mercaptols and Disulphones of Ketonic acids and Unsaturated acids derived therefrom . . .	i, 5
WALDEN (PAUL). Resolution of Racemic compounds into their active components . . .	i, 7
BILLITZER (JEAN). Affinity Coefficients of Saturated Fatty acids . . .	i, 7
ORNSTEIN (FRITZ). Water of Crystallisation in the Calcium and Barium salts of γ -Methylvaleric (Isohexoic) acid . . .	i, 7
BÉHAL (AUGUSTE). Mixed Anhydrides of Acyclic and Cyclic acids . . .	i, 8
FICHTER (FRITZ) and ALBERT KRAFFT. Vinylacetic acid . . .	i, 8
MEYER (HANS). Action of Ammonia on Lactones . . .	i, 9
AUWERS (KARL). α -Hydroxy- α -methylisohexylacetic acid [α -Hydroxy- α -dimethylheptoic acid] . . .	i, 9
WISLICIENUS (WILHELM). Influence of the Solvent on the Constitution of Ethyl Acetoacetate and similar Substances . . .	i, 9
SAEMENOFF (W.). β -Bromoglutaric acid . . .	i, 10
WEGSCHEIDER (RUDOLF). Esterification of Camphoric acid. II. . .	i, 10
WALDEN (PAUL). Behaviour of Malic acid when Heated . . .	i, 10
WALDEN (PAUL). Optical Rotation of Malic acid in the Pure State and in Solution . . .	i, 11
STRÖMHOLM (DANIEL). Diethylenedisulphidethetene . . .	i, 12
FROMM (EMIL). History of Thioacetaldehydes . . .	i, 14
IPATIEFF (WLADIMIR) [and in part A. SOLONINA]. Action of Nitrosyl Chloride on Organic compounds containing a Double Linking . . .	i, 14
ULSCH (KARL). Electrolysis of Solutions of Sucrose . . .	i, 15
TOLLENS (BERNHARD). Methyleneglucose from Glucose, Formaldehyde, and Hydrochloric acid: a new Glucoside . . .	i, 15
LE BEL (JOSEPH ACHILLE). Stereochemistry of Nitrogen . . .	i, 15
EMMERLING (OSKAR). Attempts to Prepare a Diaminovaleric acid . . .	i, 16
POSNER (THEODOR) and JOHANNES FAHRENHORST. Disulphones. II. Aminosulphonol and its derivatives and Homologues . . .	i, 16
MARKOWNIKOFF (WLADIMIR B.). Cyclic compounds: Behaviour of Cyclic compounds at Low Temperatures . . .	i, 18
KUBSANOFF (N.). Action of Zinc Methyl and Zinc Ethyl on Chlorohexa- naphthene . . .	i, 19
MOUNEYRAT (A.) and CH. POURET. Action of Bromine on Chlorobenzenes in Presence of Aluminium Chloride . . .	i, 19
VOROŽEK (EMIL) and E. ZENÍŠEK. Electrolytic Modification of Sandmeyer's and Gattermann's Reactions]. . .	i, 19

	PAGE
SCHMIDT (JULIUS). Reduction of Nitrobenzene with Sodium	i, 20
SCHMIDT (JULIUS). Action of Sodium on <i>p</i> -Nitrotoluene	i, 20
ROEDE (ALBERT). Electrolytic Reduction of <i>m</i> -Nitrotoluene	i, 20
NEF (JOHN ULRIC). Phenylacetylene, its salts and Halogen Substitution derivatives	i, 20
LJUBAVIN (NICOLAI N.) [with RESWJAKOFF, RUDENKO, and AREFEEFF]. Naphtha Tar	i, 23
GRAEBE (CARL). Conversion of 1:8- and 1:5-Dinitronaphthalenes into Nitronitrosenaphthols	i, 24
BORSCH (WALTHER). Action of Benzenediazonium Chloride on Alkaline Solutions of Nitrosophenol	i, 24
WHEELER (HENRY LORD) and WILLIAM VALENTINE. Action of Bromine on <i>m</i> -Chloro-, <i>m</i> -Bromo-, and <i>m</i> -Iodo-anilines. II.	i, 25
MÖLLER (JOHANN). Formation of Phenylcarbylamine by the Electrolysis of Alkaline Alcoholic Solutions of Nitrobenzene and Aniline	i, 27
BUSCH (MAX). Action of Hydrazine on Thiocarbanilide	i, 27
STRÖM (KNUT). Chemical Composition of Norwegian Tar from Conifers	i, 28
REVERDIN (FRÉDÉRIC) and F. ECKHARD. Chloroanisidines and Chloroanisol	i, 28
COHN (GEORG). Phenacetin	i, 29
THIELE (JOHANNES) and ROBERT HOWSON PICKARD. Transformation of Hydroxamic acids	i, 29
VANDEVELDE (ALB. J. J.). Phenoxyacetic acid. Bromination of Phenoxy-cinnamic acid	i, 30
LIMPRICHT (HEINRICH) [and THEODOR LACH]. Diphenylmethane-2:4'-dicarboxylic acid.	i, 31
LIMPRICHT (HEINRICH). Benzophenone-2:4'-dicarboxylic acid	i, 32
ERRERA (GIORGIO). Mixed Methenyl compounds. I. and II. Action of Ethyl Ethoxymethylacetate and Ethoxymethylenemalonate on Ethylacetonedicarboxylate	i, 33
CARVETH (HECTOR R.). <i>p</i> -Anisaldoximes	i, 34
AMEYE (MICHEL). Distillation of Dypnone	i, 35
HESSE (OSWALD). Pseudodicotoin	i, 35
GOLDSCHMIEDT (GUIDO) and GUSTAV KNÖFFER. Condensation of Dibenzyl Ketone with Benzaldehyde	i, 35
FULDA (HUGO LUDWIG). Condensation products of <i>o</i> -Aldehydic acids with Ketones	i, 36
WISLICIENUS (JOHANNES) [with BRUNO LÖWENSTEIN, PAUL SCHMIDT, and HARRY EDWARD WELLS]. Isomeric forms of Dibenzoylmethane	i, 37
SMITH (ALEXANDER). Potassium Cyanide as a condensing agent	i, 38
SCHIFF (ROBERT). Preparation and configuration of the six Isomeric inactive Benzylidenebisacetylacetones	i, 39
HESSE (OSWALD). Compounds from Rhubarb and allied substances	i, 40
JAUBERT (GEORGE F.). Naphthapurpurin (Trihydroxy- α -naphthaquinone)	i, 42
KLAGES (AUGUST) and A. KRAITH. The Carvone series	i, 42
KLAGES (AUGUST). Pulegone and Methylhexanone	i, 44
WALLACH (OTTO) [with EUGEN VON BIRON, TH. BÖCKER, AD. GILBERT, W. RATH, and HERM. UMBROVE]. Terpenes and Ethereal oils; Ring disruption and ring formation among Terpene derivatives	i, 44
WAGNER (GEORG) and W. BROCKNER. Relation of Pinene Hydrochloride and Hydriodide to Bornyl Chloride and Iodide	i, 46
HESSE (ALBERT). Ethereal oil of Jasmine Flower	i, 48
BAMBERGER (MAX) and ANTON LANDSIEDL. Natural Resins (Überwallungsharze). V.	i, 48
GADAMER (JOHANNES). Ethereal Oils of Cresses and the Glucosides from which they are formed	i, 49
SCHIFF (HUGO). Amygdalinamidoxime	i, 49
HAUSMANN (ARTHUR). <i>Extractum filicis aethereum</i>	i, 49
TSVETI. Constitution of the colouring matter of Leaves: Chloroglobin	i, 50
HESSE (OSWALD). Alkaloids of the <i>Solanaceae</i>	i, 50

	PAGE
ROSER (WILHELM). Narcotine	i, 51
VONGERICHTEN (EDUARD). α -Dinitrophenylpyridine Chloride	i, 51
SPIEGEL (LEOPOLD). Dinitrophenylpyridine Chloride	i, 51
KIRPAL (ALFRED). Alkyl salts of Quinolinic and Cinchomeric acids	i, 51
GUARESOHI (ICILIO). Dicyanohydroxypyridones	i, 52
FULDA (HUGO LUDWIG). Benzoylpyridinecarboxylic acids	i, 53
GABRIEL (SIEGMUND) and JAMES COLMAN. Derivatives of 4-Methylpyrimidine [4-methyl- <i>m</i> -diazine]	i, 53
BÜLOW (CARL) and ALFRED SCHLESINGER. Preparation of Isopyrazole derivatives from Diethyl Benzeneazodiacetylsuccinate	i, 56
SCHUYTEN (M. C.). Double Chlorides of Copper and Antipyrine	i, 57
SCHUYTEN (M. C.). Metallic Benzopyrines	i, 57
SCHUYTEN (M. C.). Constitution of Metallic Salipyrynes	i, 57
WERNER (ALFRED) and TH. HERBERGER. Formation of Ring compounds by elimination of Aromatic Nitro-groups	i, 57
BUSCH (MAX) [and LUDWIG HARTMANN]. Triazines from <i>o</i> -Aminoazo-compounds	i, 59
KEHRMANN (FRIEDRICH) and P. FILATOFF. The Eighth and Ninth Isomerides of Rosinduline	i, 60
KEHRMANN (FRIEDRICH) and ZENAIDE KIKINE. Nitro- and Amino-flavindulines	i, 61
KEHRMANN (FRIEDRICH) [with KRAMER, L. SCHILD, and P. THOMAS]. Constitution of Oxazine Dyes, and Quadrivalent Oxygen	i, 61
BEHREND (ROBERT) and RICHARD GRÜNWALD. Aminouracil	i, 63
FISCHER (EMIL) and FRIEDRICH ACH. Isomerism of the Methyluric acids	i, 63
BÜLOW (CARL). Inactive <i>b-p</i> -Nitranilineazobenzoylacetone [<i>p</i> -Nitrobenzene-azobenzoylacetone]	i, 65
BUSCH (MAX) and E. LINGENBRINK. Hydrazones of Dithiocarbonates	i, 66
BLUM (F.). The Iodine Number of Proteids	i, 67
TSVETT. Reversible Liquefaction of Proteids	i, 67
KUTSCHER (FR.). Detection of Glutaric acid amongst the products obtained by decomposing Albumin of Animal origin with strong Sulphuric acid	i, 67
PICK (ERNST P.). Products of the Peptic digestion of Fibrin	i, 68
KÜSTER (WILLIAM). Products of the decomposition of Hæmatin	i, 68
KÜSTER (WILLIAM) and MARTIN KÖLLE. Preparation and products of decomposition of Hæmatoporphyrin	i, 69
LIVERSIDGE (ARCHIBALD). Blue Pigment in Coral (<i>Heliopora cœrulea</i>) and other animal organisms	i, 70
BOLAND (G. W.). Pyocyanin, the Blue Colouring matter of <i>Bacillus pyocyanus</i>	i, 70
PANZER (THEODORE). Ovarian Colloid	i, 70
GIERTZ (K. H.). Pseudo-nucleins	i, 71
FLEROFF (A.). Histon-like substance from the Thymus	i, 71
LAWBOFF (D.). Decomposition products of Histon from Leucocytes	i, 71
KOSSEL (ALBRECHT) [CARL LUDWIG MARTIN LEONHARD] and FR. KUTSCHER. Histidine	i, 71
WETZEL (G.). Decomposition products of Conchiolin	i, 71
KLIMMER (MARTIA). Lilienfeld's synthesis of Peptone	i, 72
KUTSCHER (FR.). Antipeptone	i, 72
MORKOWIN (N.). Protamines	i, 72
ABEL (JOHN J.). Epinephrine	i, 72

PART II.

General and Physical Chemistry.

	PAGE
LEWIS (PEROVAL). Influence of slight Impurity on the Spectrum of a Gas	ii, 1
MAROKWALD (WILHELM). Phototropy	ii, 2
SCHAUM (KARL). Concentration Cells with unalterable Electrodes	ii, 2
DOLEZALEK (F.). Theory of Lead accumulators	ii, 2
COOLIDGE (W. D.). Dielectrical Researches and Electric Waves	ii, 3
KÖSTERS (WILHELM). Electrical Charges of Freshly Prepared Gases from Electrolytic sources	ii, 4
SUNDORPH (TH.). Change of Resistance of Lead Dioxide	ii, 5
ABEGG (RICHARD). Electrolytic Conductivity of Pure Substances	ii, 5
TINGLE (ALFRED). Influence of Substituents on the Electrical Conductivity of Benzoic acid	ii, 6
LINCOLN (AZARIAH T.). Electrical Conductivity of Non-aqueous solutions	ii, 6
CASPARI (WILLIAM AUGUSTUS). Electrolytic Gas Development	ii, 7
MEYER (STEFAN). Magnetic Susceptibility of Inorganic compounds	ii, 7
PALMAER (WILHELM). A Simple Protection for Fused-in Platinum Wires	ii, 8
DELÉPINE (MARCEL) and L. A. HALLOPEAU. Heat of Oxidation of Tungsten	ii, 8
BIGELOW (SAMUEL LAWRENCE). A Simplification of Beckmann's Boiling Point Apparatus	ii, 9
HALL (EDWIN H.). Relation between Pressure and Evaporation	ii, 9
HIRSCH (RUDOLF FREIHERR VON). Density of Liquids and Saturated Vapours	ii,
EMDEN (ROBERT). Phenomena of Effusion of Permanent Gases	ii, 10
SPEYERS (CLARENCE LIVINGSTON). Van't Hoff's Equation and the Molecular Weight of Liquids	ii, 10
WALDEN (PAUL). A new Inorganic Dissociative Solvent	ii, 10
STROCKEL (K.) and LUDWIG VANINO. Nature of Colloidal Solutions	ii, 11
BRÜHL (JULIUS WILHELM). Function of the Medium in Chemical Change	ii, 11
BODENSTEIN (MAX). Gaseous Reactions in Chemical Kinetics. VI., VII.	ii, 12
HOFF (JACOBUS HENRICUS VAN'T) and WILHELM MEYERHOFFER. Application of the Equilibrium Law to the formation of Oceanic Salt Deposits. (XI.) Equilibrium Relations of Carnallite	ii, 12

Inorganic Chemistry.

MOISSAN (HENRI). Production of Ozone by the Decomposition of Water by Fluorine	ii, 13
NABL (ARNOLD). Hyposulphurous acid	ii, 13
SABANÉEFF (ALEXANDER) [with A. DSCHEWACHOFF, M. EFROSS, Z. GINSBURG, J. LEMKE, M. PROSSIN, and A. WLASOFF]. Isomerism of salts of Ammonia, Hydroxylamine, and Hydrazine	ii, 13
HUGOT (C.). Action of Potassammonium on Arsenic	ii, 14
GAUTIER (HENRI). Atomic Weight of Boron	ii, 14, 15
STAUDENMAIER (LUDWIG). Graphite	ii, 15
FORMÁNEK (JULIUS). Treatment of Lepidolite	ii, 15
MOISSAN (HENRI). Commercial Calcium Carbide	ii, 15
TOMMASI (DONATO). Action of Magnesium on Saline solutions	ii, 16
ENGEL (RODOLPHE [CHARLES]). Anhydrous Magnesium Carbonate	ii, 17
JONES (WILLIAM APP). Dicarboxyl Cuprous Chloride	ii, 17

	PAGE
MUTHMANN (WILHELM) and L. STÜTZEL. Spectroscopic Analysis of Neodymium and Praseodymium	ii, 18
GIESEL (FRITZ). Radio-active Barium salts and Polonium	ii, 19
DEBIERNE (A.). A New Radio-active substance	ii, 20

Mineralogical Chemistry.

CLAESSEN (C.). Dopplerite	ii, 20
BEDSON (PETER PHILLIPS). New Zealand Coal and Ambrite. Barbados Manjak	ii, 20
PRIOR (GEORGE THUELAND) and LEONARD JAMES SPENCEER. Identity of Binnite with Tennantite: Composition of Fahlerz	ii, 21
HILLEBRAND (WILLIAM FRANCIS). Melonite (?), Coloradoite (?), Petzite and Hessite	ii, 22
MALLET (FREDERICK RICHARD). Langbeinite from the Punjab Salt Range	ii, 22
HOFF (JACOBUS H. VAN'T) and WILHELM MEYERHOFFER. Formation of Oceanic Salt Deposits, particularly of the Stassfurt Salt Beda. XIII. Evaporation of Sea Water at 25°	ii, 23
HARTLEY (ERNAUD GEORGE JUSTINIAN). Pharmacosiderite	ii, 23
PRATT (JULIUS HOWARD). [Chabazite] from North Carolina	ii, 24
CLARKE (FRANK WIGGLESWORTH) and GEORGE STEIGER. Constitution of Pectolite, Pyrophyllite, Hemimorphite and Analcite	ii, 24
WÜLFING (ERNST A.). Analysis of Rocks	ii, 25
BAUER (K.). Experimental Petrology	ii, 26
TARASSENKO (W.). [Mineral Analyses]	ii, 26
PHILLIPS (ALEXANDER HAMILTON). Trap-rock of Rocky Hill, New Jersey	ii, 27
WASHINGTON (HENRY S.). Analyses of Italian Volcanic Rocks	ii, 27
FLETCHER (LAZARUS). Meteoric Iron from Caperr, Patagonia	ii, 27
FLETCHER (LAZARUS). Cliftonite and Tænite in the Youndeggin Meteoric Iron	ii, 27
FERREIRA DA SILVA (ANTONIO JOAQUIM) and ALBERT D'AGUIAR. Fluorine in the Mineral Waters of Portugal and Spain	ii, 28

Physiological Chemistry.

PFÖRRINGER (S.). Autodigestion of the Pancreas	ii, 28
LAWROFF (D.). Action of Arginine on the Tryptic Digestion of Proteid	ii, 28
HAERMS (HEINRICH). The Fluorine in Tooth- and Bone-ash	ii, 29
BUNGE (GUSTAV VON). Composition of the Cartilage of the Shark	ii, 29
SEEGEN (JOSEF). Substances present in the Liver which are converted into Sugar by acids	ii, 29
GOTTJEB (RUDOLF). Amount of Urea in the Liver	ii, 29
ZEYNEK (RICHARD VON). Human Bile	ii, 29
KRÜGER (MARTIN). Degradation of Caffeine in the Organism of the Dog	ii, 30
KRÜGER (MARTIN) and PAUL SCHMIDT. Decomposition of Theobromine, Paraxanthine, and 4-Methylxanthine in the Animal Organism	ii, 31
WALLACE (GEORGE B.) and ARTHUR R. CUSHNY. Intestinal Absorption and Saline Cathartics	ii, 31
VITALI (DIOSCORIDE). Passage into the Urine of Chloroform administered by Inhalation	ii, 31
MORACZEWSKI (WACLAW VON). Excretion in Blood-free and in Fasting Frogs	ii, 31
LINDEMANN (W.). Fat of Normal and Degenerated Heart Muscle	ii, 32
SABBATANI (LUIGI). [Physiological Action of] Acetonedicarboxylic acid and Citric acid	ii, 32

Chemistry of Vegetable Physiology and Agriculture.

	PAGE
KUSSEKOW (R.). [Effect of Mineral and Nitrogenous Nutritive Matters on the Fermenting Capacity of Yeasts]	ii, 33
BÖTTINGER (CARL). Yeast	ii, 33
WARD (H. MARSHALL) and JOSEPH REYNOLDS GREEN. A Sugar Bacterium	ii, 33
BEDDIES (ALFRED). Permanent Forms of Nitric and Nitrous Organisms .	ii, 34
BOURQUELOT (ÉMILE) and HENRI HÉRISSEY. Germination of the Carob Bean (<i>Ceratonia siliqua</i>). Production of Mannose by a soluble ferment	ii, 35
COUPIN (HENRI). Action of Anæsthetic Vapours on the vitality of dry and moist Seeds	ii, 35
BÉAL (ÉMILE). Absorption of Water and dissolved substances by the Stems of Plants	ii, 35
TUCKER (G. M.) and BERNHARD TOLLENS. Food-stuffs of the Leaves of the Plane Tree and their migration during the growth and decay of the leaves	ii, 35
LOEW (OSCAR). Replacement of Potassium salts by Rubidium salts in lower Fungi	ii, 36
SCHUNCK (C. A.). Yellow Colouring Matters accompanying Chlorophyll and their Spectroscopic Relations	ii, 36
FRANKFORTER (GEORGE BELL) and E. P. HARDING. Wheat	ii, 37
WOLFF (JULES). Constituents of Chicory	ii, 37
KONDAKOFF (IWAN L.). Constituents of Flores Kosso	ii, 38
KONDAKOFF (IWAN L.) and N. SCHATZ. Kossin or Taeniin of Pavani and Vée	ii, 38
WISLIËNUS (HANS). Detection of Sulphur Dioxide in the Atmosphere of the Tharandt Forest	ii, 38
ZEGA (ALEXANDER) and R. MAJSTOROVIC. Maize as Food in Servia	ii, 39
RAMM (EBERHARD) and W. MINTROP. Determination of the action of some Foods on the Secretion of Milk, with special reference to the amount of fat in the rations formed with these foods	ii, 39
KNIERIM (WOLDEMAR VON). Value of various Concentrated Foods	ii, 39
WEIGMANN (H.). In feeding with Sesame Cake, do substances which give the Baudouin reaction appear in the Butter?	ii, 40
TRAPHAGEN (FRANK W.) and W. M. COBLEIGH. Alkali soils of Montana	ii, 40
STOKLASA (JULIUS). Distribution and Biological importance of Furfuroids in Soil	ii, 40
JENKINS (EDWARD H.). Observations on the Growth of Maize continuously for nine years	ii, 41
HANAMANN (JOSEPH). Manurial Experiments with Barley	ii, 41
MAEROKER (MAX [HEINRICH]). Manurial Experiments with Lucerne	ii, 41
JOHNSON (SAMUEL WILLIAM), EDWARD H. JENKINS, and W. E. BRITTON. Experiments on the availability of Fertiliser Nitrogen	ii, 42
MAEROKER (MAX [HEINRICH]). Manurial Experiments on Meadow Land .	ii, 42
TACKER (BRUNO). Field Experiments on Peat Land	ii, 42
SEMPOŁOWSKI (A.). Manurial Experiments with Phosphates and Basic Slag	ii, 43
MENOZZI (ANGELO). Comparison between Bone and Mineral Superphosphates	ii, 43
TSUNETO (K.). Phosphatic Deposits in Japan	ii, 43
SCHUCHT (LUDWIG). The Reversion of Soluble Phosphoric acid in Superphosphates	ii, 44

Analytical Chemistry.

SEYDA (ANTON). Standardising Amids	ii, 44
PECKHAM (STEPHEN FARNUM) and H. E. PECKHAM. Estimation of Sulphur in Bitumens	ii, 44
FRADISS, (N.). Estimation of Hyposulphurous acid	ii, 44

	PAGE
LITTERSCHEID (FRANZ) and KARL FEIST. Volumetric estimation of Sulphuric acid	ii, 45
LE BLANC (MAX) and M. ECKARDT. Titration of Persulphates	ii, 45
GOOCH (FRANK AUSTIN) and C. A. PETERS. Estimation of Tellurous acid in presence of Haloid salts	ii, 45
VITALI (DIOSCORIDE). Detection of Nitric acid in Cadaveric Matter	ii, 46
SMITH (THORN). Estimation of Arsenic in Paris Green	ii, 47
SARGENT (GEORGE WILLIAM). Estimation of Boric acid in Tourmaline	ii, 47
JONES (LOUIS CLEVELAND). Iodometric Method for the Estimation of Boric acid	ii, 47
SCHÜTTE (H.). Stutzer and Hartleb's Process for the Estimation of combined Carbon Dioxide in Soils	ii, 48
SCHALLER (ROBERT). Gas-washing Apparatus: Rapid and accurate Process for the Estimation of Carbon Dioxide	ii, 48
NOLL (HERMANN). Estimation of Calcium Carbonate in Marls	ii, 48
MEADE (RICHARD K.). New Volumetric Method for the Estimation of Magnesium	ii, 48
AUSTIN (MARTHA). Double Ammonium Phosphates of Beryllium, Zinc, and Cadmium in Analysis	ii, 49
MACKEY (P. A.). Analysis of Zinc for Cadmium and Lead	ii, 49
RIEDERER (EMIL J.). Electrolytic Estimation of Zinc in the presence of Manganese	ii, 49
HESS (WILLIAM H.) and EDWARD D. CAMPBELL. Direct estimation of Aluminium in the presence of Iron, Manganese, Calcium, and Magnesium	ii, 50
NAMIAS (RODOLFO). Volumetric estimation of Manganese	ii, 50
SHIMER (PORTER W.). A simplified Reductor	ii, 50
HAYENS (FRANKE STUART) and ARTHUR F. WAT. Separation of Iron from Chromium, Zirconium, and Beryllium by the Action of Hydrogen Chloride on the Oxides	ii, 50
SARGENT (GEORGE WILLIAM). Estimation of Nickel in Nickel Steel	ii, 51
ULLMANN (FRITZ) and IRMA GOLDBERG. Estimation of Chromic acid in Acetylene Purifiers	ii, 51
BROWN (THOMAS, JUN.). Estimation of Antimony in Ores	ii, 51
TUCKER (G. M.). Apparatus for the Preparation of Plant Ash for Analysis	ii, 52
ILOSVAY VON NAGY ILOSVÁ (LUDWIG). Ammoniacal Copper Solutions and Hydroxylamine as a Test for Acetylene	ii, 52
JANDRIER (EDMOND). A Colour Test for the Detection of Methyl Alcohol	ii, 52
FRESENIUS (WILHELM) and LEO GRÜNHUT. Recognition of Marc Wines (Tresterweine)	ii, 52
ADAM (FRANZ). Volumetric Estimation of Alcohols, especially of Fusel Oil in Brandies	ii, 53
DITZ (HUGO) and FRANZ CRDIVODA. Action of Bromine on Phenol and Cresols with reference to the Analysis of Mixtures of these compounds	ii, 54
KOWARSKY (ALBERT). Simplification of the Phenylhydrazine Test for Sugar in Urine	ii, 54
HOITSEMA (C.). Stability of Guncotton and Smokeless Powder	ii, 55
BROWNE (C. A.). Chemistry of Butter-fat. II. Chemical Composition of Butter-fat	ii, 55
STEBBINS (JAMES H.). The Reichert Number for Butter	ii, 55
FUNARO (ANGIOLO). Analysis of Beeswax	ii, 55
SOHN (KARL BERNHARD). The Sesame Oil Reaction and Sesame Butter	ii, 55
WEIGMANN (H.). [Testing Butter for Oil of Sesame]	ii, 56
CLOWES (G. H. A.) and BERNHARD TOLLENS. Detection and Estimation of Formaldehyde in the Free State and in its compounds	ii, 56
SABBATANI (LUIGI). [Separation of Acetone from Acetoacetic and Acetone-dicarboxylic acids]	ii, 56
RIMINI (ENRICO). New Reaction of Acetone and a new method for the Detection of Aliphatic Amines	ii, 56

	PAGE
VALEUR (AMAND). Volumetric Estimation of Quinones derived from Benzene	ii, 57
CUNIASSE (L.). A Colour Reaction to distinguish the Hydrochlorides of Meta- and Para-phenylenediamine	ii, 57
GOTTLIEB (RUDOLF). Estimation of Urea in the Tissues and the amount contained in the Liver	ii, 57
VITALI (DIOSCORIDE). Detection of "Saccharin" in Wines	ii, 57
SCHAEER (EDUARD). Employment of Chloral Hydrate in the Estimation of Alkaloids	ii, 57
SCHAEFER (GEORGE L.). The Chromic acid Test for Cocaine	ii, 58
MICKO (KARL). The Active Principle of Cayenne Pepper	ii, 58
GARNIER (LÉON) and L. MICHEL. Detection of Nucleo-albumin in Urine by means of Tannin	ii, 58
EFFRONT (JEAN). Estimation of the Products of Digestion with Pepsin	ii, 59
FAHRION (WILHELM). Analysis of Glue and Leather	ii, 59
ASCHMAN (C.) and HAROLD FABER. Estimation of Humus in Soils	ii, 60
CLAYTON (EDWY G.). Analyses of Ginger	ii, 60

INDEX OF AUTHORS' NAMES.

A.

Abegg, R., ii, 5.
 Abel, J. J., i, 72.
 Ach, F. See E. Fischer.
 Adam, F., ii, 53.
 Ahrens, F. B., i, 1.
 Ameye, M., i, 35.
 Areféeff. See N. Ljubavin.
 Aschman, C., and H. Faber, ii, 60.
 Austin, M., ii, 49.
 Auwers, K., i, 9.

B.

Bamberger, M., and A. Landsiedl, i, 48.
 Bauer, K., ii, 26.
 Beddies, A., ii, 34.
 Bedson, P. P., ii, 20.
 Béhal, A., i, 8.
 Behrend, R., and R. Grünwald, i, 63.
 Berthelot, M. P. E., i, 3.
 Bigelow, S. L., ii, 9.
 Billitzer, J., i, 7.
 Biron, E. von. See O. Wallach.
 Blum, F., i, 67.
 Bodenstein, M., ii, 12.
 Böcker, T. See O. Wallach.
 Böttinger, C., ii, 33.
 Roland, G. W., i, 70.
 Borsche, W., i, 24.
 Bourquelot, E., and H. Hérissé, ii, 35.
 Bréal, E., ii, 35.
 Brickner, W. See G. Wagner.
 Britton, W. E. See S. W. Johnson.
 Brown, T., jun., ii, 51.
 Browne, C. A., ii, 55.
 Brühl, J. W., ii, 11.
 Bülow, C., i, 65.
 Bülow, C., and A. Schlesinger, i, 56.
 Bunge, G. von, ii, 29.
 Busch, M., i, 27.

Busch, M., and L. Hartmann, i, 59.
 Busch, M., and E. Lingenbrink, i, 66.

C.

Campbell, E. D. See W. H. Hesa.
 Carveth, H. R., i, 34.
 Caspari, W. A., ii, 7.
 Cedivoda, F. See H. Ditz.
 Claessen, C., ii, 20.
 Clarke, F. W., and G. Steiger, ii, 24.
 Clayton, E. G., ii, 60.
 Clowes, G. H. A., and B. Tollens, ii, 56.
 Cobleigh, W. M. See F. W. Trap-
 hagen.
 Cohn, G., i, 29.
 Colman, J. See S. Gabriel.
 Coolidge, W. D., ii, 3.
 Cormack, W. See J. Walker.
 Coupin, H., ii, 35.
 Crossley, A. W., and H. R. Le Sueur,
 TRANS., 83.
 Cuniasso, L., ii, 57.
 Cushny, A. R. See G. B. Wallace.

D.

D'Aguiar, A. See A. J. Ferreira da
 Silva.
 Davis, W. A., TRANS., 83.
 Debiérne, A., ii, 20.
 Delépine, M., and L. A. Hallopeau,
 ii, 8.
 Ditz, H., and F. Cedivoda, ii, 54.
 Dolezalek, F., ii, 2.
 Dootson, F. W. See W. J. Sell.
 Dschewachoff, A. See A. Sabanéeff.
 Dunstan, W. R., and H. M. Read,
 TRANS., 45.

E.

Eckardt, M. See M. Le Blanc.
 Eckhard, F. See F. Reverdin.
 Effront, J., ii, 59.
 Efross, M. See A. Sabanéeff.
 Emden, R., ii, 10.
 Emmerling, O., i, 16.
 Engel, R., ii, 17.
 Errera, G., i, 38.

F.

Faber, H. See C. Aschman.
 Fahrenhorst, J. See T. Posner.
 Fahrion, W., ii, 59.
 Feist, K. See F. Litterscheid.
 Fenton, H. J. H., and H. O. Jones,
 TRANS., 69, 77.
 Ferreira da Silva, A. J., and A.
 D'Aguiar, ii, 28.
 Fichter, F., and A. Krafft, i, 8.
 Filatoff, P. See F. Kehrman.
 Fischer, E., and F. Ach, i, 63.
 Fleroff, A., i, 71.
 Fletcher, L., ii, 27.
 Formánek, J., ii, 15.
 Fradiss, N., ii, 14.
 Frankforter, G. B., and E. P. Har-
 ding, ii, 37.
 Fresenius, W., and L. Grünhut,
 ii, 52.
 Fromm, E., i, 14.
 Fulda, H. L., i, 36, 53.
 Funaro, A., ii, 55.

G.

Gabriel, S., and J. Colman, i, 53.
 Gadamer, J., i, 49.
 Garnier, L., and L. Michel, ii, 58.
 Gautier, H., ii, 14, 15.
 Giertz, K. H., i, 71.
 Giesel, F., ii, 19.
 Gilbert, A. See O. Wallach.
 Ginsburg, Z. See A. Sabanéeff.
 Goldberg, I. See F. Ullmann.
 Goldschmiedt, G., and G. Knöpfer,
 i, 35.
 Gooch, F. A., and C. A. Peters,
 ii, 45.
 Gottlieb, R., ii, 29, 57.
 Graebe, C., i, 24.
 Green, J. R. See H. M. Ward.
 Grünhut, L. See W. Fresenius.
 Grünwald, R. See R. Behrend.
 Guareschi, I., i, 52.

H.

Hall, A. H., ii, 9.
 Hallopeau, L. A. See M. Delépine.
 Hanamann, J., ii, 41.
 Harding, E. P. See G. B. Frank-
 forter.
 Harms, H., ii, 29.
 Hartley, E. G. J., ii, 23.
 Hartmann, L. See M. Busch.
 Hausmann, A., i, 49.
 Havens, F. S., and A. F. Way, ii, 50.
 Herberger, T. See A. Werner.
 Hérissé, H. See E. Bourquelot.
 Hess, W. H., and E. D. Campbell
 ii, 50.
 Hesse, A., i, 48.
 Hesse, O., i, 35, 40, 50.
 Hewitt, J. T., TRANS., 99.
 Hillebrand, W. F., ii, 22.
 Hirsch, R. F. von, ii, 9.
 Hodgkinson, W. R., and L. Lim-
 pach, TRANS., 65.
 Hoff, J. H. van't, and W. Meyer-
 hoffer, ii, 12, 23.
 Hoitsema, C., ii, 55.
 Hugot, C., ii, 14.

I.

Ilosvay von Nagy Ilosva, L., ii, 52.
 Ipatieff, W., and A. Solonina, i, 3, 14.

J.

Jandrier, E., ii, 52.
 Jaubert, G. F., i, 42.
 Jenkins, E. H., ii, 41.
 Jenkins, E. H. See also S. W. Johnson.
 Johnson, S. W., E. H. Jenkins, and
 W. E. Britton, ii, 42.
 Jones, H. O. See H. J. H. Fenton.
 Jones, L. C., ii, 47.
 Jones, W. A., ii, 17.

K.

Kehrman, F., and P. Filatoff, i, 60.
 Kehrman, F., and Z. Kikine, i, 61.
 Kehrman, F., Kramer, L. Schild,
 and P. Thomas, i, 61.
 Kikine, Z. See F. Kehrman.
 Kirpal, A., i, 51.
 Klages, A., i, 44.
 Klages, A., and A. Kraith, i, 42.
 Klimmer, M., i, 72.
 Knierim, W. von, ii, 39.
 Knöpfer, G. See G. Goldschmiedt

Kölla, M. See W. Küster.
 Kösters, W., ii, 4.
 Kondakoff, I. L., ii, 38.
 Kondakoff, I. L., and N. Shatz,
 ii, 38.
 Kossel, A., and F. Kutscher, i, 71.
 Kowarsky, A., ii, 54.
 Krafft, A. See F. Fichter.
 Kramer. See F. Kehrmann
 Krüger, M., ii, 30.
 Krüger, M., and P. Schmidt, ii, 31.
 Küster, W., i, 68.
 Küster, W., and M. Kölle, i, 69.
 Kursanoff, N., i, 19.
 Kusserow, R., ii, 33.
 Kutscher, F., i, 67, 72,
 Kutscher, F. See also A. Kossel.

L.

Lach, T. See H. Limpricht.
 Landsiedl, A. See M. Bamberger.
 Lawroff, D., i, 71; ii, 28.
 Le Bel, J. A., i, 15.
 Le Blanc, M., and M. Eckardt,
 ii, 45.
 Lemke, J. See A. Sabanéeff.
 Le Sueur, H. R. See A. W. Crossley.
 Lewis, P., ii, 1.
 Limpach, L. See W. R. Hodgkin-
 son.
 Limpricht, H., i, 32.
 Limpricht, H., and T. Lach, i, 31.
 Lincoln, A. T., ii, 6.
 Lindemann, W., ii, 32.
 Lingenbrink, E. See M. Busch.
 Litterscheid, F., and K. Feist, ii, 45.
 Liversidge, A., i, 70.
 Ljubavin, N., N. Reswjakoff, Ru-
 denko, and Areféeff, i, 23.
 Loew, O., ii, 36.
 Lowenstein, B. See J. Wislicenus.

M.

Mackay, P. A., ii, 49.
 Maercker, M., ii, 41, 42.
 Majstorović, R. See A. Zega.
 Mallet, F. R., ii, 22.
 Marckwald, W., ii, 2.
 Markownikoff, W. B., i, 18.
 Meade, R. K., ii, 48.
 Menozzi, A., ii, 43.
 Meyer, H., i, 9.
 Meyer, S., ii, 7.
 Meyerhoffer, W. See J. H. van't
 Hoff.
 Michel, L. See L. Garnier.
 Micko, K., ii, 58.

Mintrop, W. See E. Ramm.
 Möller, J., i, 27.
 Moissan, H., ii, 13, 15.
 Moraczewski, W. von, 31
 Morkowin, N., i, 72.
 Mouneyrat, A., and C. Pouret, i, 19
 Muthmann, W., and L. Stützel, ii, 18.

N.

Nabl, A., ii, 13.
 Namias, R., ii, 50.
 Nef, J. U., i, 2, 4, 20.
 Noll, T., ii, 48.

O.

Ornstein, F., i, 7.

P.

Palmaer, W., ii, 8.
 Panzer, T., i, 70.
 Peckham, S. F., and H. E. Peckham,
 ii, 44.
 Peters, C. A. See F. A. Gooch.
 Pförringer, S., ii, 28.
 Phillips, A. H., ii, 27.
 Pick, E. P., i, 68.
 Pickard, R. H. See J. Thiele.
 Posner, T., i, 5.
 Posner, T., and J. Fahrenhorst, i, 16.
 Pouret, C. See A. Mouneyrat.
 Pratt, J. H., ii, 24.
 Prior, G. T., and L. J. Spencer,
 ii, 21.
 Prossin, M. See A. Sabanéeff.

R.

Ramm, E., and W. Mintrop, ii, 39.
 Rath, W. See O. Wallach.
 Read, H. M. See W. R. Dunstan.
 Reiderer, E. J., ii, 49.
 Reswjakoff. See N. Ljubavin.
 Reverdin, F., and F. Eckhard, i, 28.
 Rimini, E., ii, 56.
 Rohde, A., i, 20.
 Roser, W., i, 51.
 Rudenko. See N. Ljubavin.

S.

Sabanéeff, A., A. Dschewachoff, M.
 Efross, Z. Ginsburg, J. Lemke,
 M. Prossin, and A. Wlassoff, ii, 13.

Sabbatani, L., ii, 32, 56.
 Sargent, G. W., ii, 47, 51.
 Schaefer, G. L., ii, 58.
 Schaer, K., ii, 57.
 Schaller, R., ii, 48.
 Schatz, N. See I. L. Kondakoff.
 Schaum, K., ii, 2.
 Schiff, H., i, 49.
 Schiff, R., i, 39.
 Schild, L. See F. Kehrman.
 Schlesinger, A. See C. Bülow.
 Schmidt, J., i, 20.
 Schmidt, P. See M. Krüger; J. Wislicenus.
 Schucht, L., ii, 44.
 Schütte, H., ii, 48.
 Schunck, C. A., ii, 36.
 Schuyten, M. C., i, 57.
 Seegen, J., ii, 29.
 Sell, W. J., and F. W. Dootson, TRANS., 1.
 Sempolowski, A., ii, 43.
 Seyda, A., ii, 44.
 Shimer, P. W., ii, 50.
 Smith, A., i, 38.
 Smith, T., ii, 47.
 Sohn, K. B., ii, 55.
 Solonina, A. See W. Ipatieff.
 Spencer, L. J. See G. T. Prior.
 Speranski, N., i, 3.
 Speyers, C. L., ii, 10.
 Spiegel, L., i, 51.
 Saemenoff, W., i, 10.
 Staudenmaier, L., ii, 15.
 Stebbins, J. H., ii, 55.
 Steiger, G. See F. W. Clarke.
 Stoeckel, K., and L. Vanino, ii, 11.
 Stoklasa, J., ii, 40.
 Ström, K., i, 28.
 Strömholm, D., i, 12.
 Stutzel, L. See W. Muthmann.
 Sundorph, T., ii, 5.

T.

Tacke, B., ii, 42.
 Tarassenko, W., ii, 26.
 Thiele, J., i, 2.
 Thiele, J., and R. H. Pickard, i, 29.
 Thomas, P. See F. Kehrman.
 Tingle, A., ii, 6.
 Tollens, B., i, 15.
 Tollens, B. See G. H. A. Clowes; G. M. Tucker.
 Tommasi, D., ii, 16.
 Traphagen, F. W., and W. M. Cobleigh, ii, 40.
 Tsuneto, K., ii, 43.
 Tsvett, i, 50, 67.

Tucker, G. M., ii, 52.
 Tucker, G. M., and B. Tollens, ii, 36.

U.

Ullmann, F., and I. Goldberg, i, 1; ii, 51.
 Ulsch, K., i, 15.
 Umbgrove, H. See O. Wallach.

V.

Valentine, W. See H. L. Wheeler.
 Valeur, A., ii, 57.
 Vandevelde, A. J. J., i, 30.
 Vanino, L. See K. Stoeckel.
 Vitali, D., ii, 31, 46, 57.
 Vongerichten, E., i, 51.
 Votoček, K., and E. Zonišek, i, 19.

W.

Wagner, G., and W. Brickner, i, 46.
 Walden, P., i, 7, 10, 11; ii, 10.
 Walker, J., and W. Cormack, TRANS., 5.
 Walker, J., and J. K. Wood, TRANS., 21.
 Wallace G. B., and A. R. Cushny, ii, 31.
 Wallach, O., E. von Biron, T. Böcker, A. Gilbert, W. Rath, and H. Umbgrove, i, 44.
 Ward, H. M., and J. R. Green, ii, 33.
 Washington, H. S., ii, 27.
 Way, A. F. See F. S. Havens.
 Wegscheider, R., i, 10.
 Weigmann, H., ii, 40, 56.
 Wells, H. E. See J. Wislicenus.
 Werner, A., and T. Herberger, i, 57.
 Wetzol, G., i, 71.
 Wheeler, H. L., and W. Valentine, i, 25.
 Wislicenus, H., ii, 32.
 Wislicenus, J., B. Löwenstein, P. Schmidt, and H. E. Wells, i, 37.
 Wislicenus, W., i, 9.
 Wlassoff, A. See A. Sabanéeff.
 Wolff, J., ii, 37.
 Wood, J. K. See J. Walker.
 Wülfling, E. A., ii, 25.

Z.

Zega, A., and R. Majstorović, ii, 39.
 Zonišek, E. See K. Votoček.
 Zeynek, R. von, ii, 29.

ERRATA.

VOL. LXXIV. (ABSTR., 1898).

PART I.

Page.	Line.	
700	4*	for "α-uric" read "α-methyluric."

VOL. LXXV. (TRANS., 1899).

98	6	„ "ce" read "ice."
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VOL. LXXVI. (ABSTR., 1899).

PART I.

268	13*	„ "sulphuric" read "nitric."
848	10*	„ " $C_3H_4(OH:CHMe)$ " read " $C_3H_4(OH:CHMe)_2$."
875	20*	„ "propylic" read "isopropylic."
887	5*	„ " $NHPh \cdot CO \cdot NH_2R$ " read " $NHPh \cdot CO \cdot NHR$."
891	21*	„ "-3-dinitro-" read "-3 : α-dinitro-."
917	8*	„ "α-Dinaphthylbenzene" read "α-Dinaphthylbenzidine."

PART II.

725	22	„ "Cd CdCl ₂ Cl ₂ " read "Cd CdCl ₂ Cl."
762	14	„ "József" read "JÓZSEF."

* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
X.—Preparation of Benzeneazo- <i>o</i> -nitrophenol. By J. T. HEWITT (continued)	101
XI.—Ethyl Dibromobutanetetracarboxylate and the Synthesis of Tetrahydrofurfuran-2:5-dicarboxylic Acid. By BEVAN LEAN, D.Sc., B.A.	103
XII.—The Atomic Weight of Nitrogen. By GEORGE DEAN, B.A.	117
XIII.—Formation of α - and β -Acrose from Glycollic Aldehyde. By HENRY JACKSON, B.A., Fellow of Downing College, Cambridge	129
XIV.—Substituted Nitrogen Chlorides and their Relation to the Substitution of Halogen in Anilides and Anilines. Part II. The Trichlorophenyl Acyl Nitrogen Chlorides. By F. D. CHATTAWAY and K. J. P. ORTON	134
XV.—The Decomposition of Chlorates, with Special Reference to the Evolution of Chlorine and Oxygen. Part I. By WILLIAM H. SODEAU, B.Sc.	137
XVI.—The Interaction of Sulphuric Acid and Potassium Ferrocyanide. By RICHARD HALIBURTON ADIE, M.A., B.Sc., and KENDALL COLIN BROWNING, B.A.	150
XVII.—Action of Alkyl Iodides on the Mercuric Iodide Sulphides of the Fatty Series. By SAMUEL SMILES, B.Sc.	160

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

KRÄMER (GUSTAV) and ADOLF SPILKER. The Wax of <i>Bacillariaceæ</i> and its connection with Petroleum	i, 73
CHARITSCHEFF (K. W.). Heptane contained in Grosny Naphtha	i, 74
GOOCH (FRANK A.) and DR FOREST BALDWIN. Action of Acetylene on Oxides of Copper	i, 74
SERRA (E.). Preparation of Tetrachloromethane	i, 74

	PAGE
STEFFENS (CARL). Isomeric compounds, $C_6H_5O_4N_4$, from Acetylmethyl-nitrolic acid	i, 74
CAVALIER (JACQUES). Phosphoric Esters	i, 75
GUÉDRAS (MARCEL). Manufacture of Glycerophosphates	i, 75
SMITH (EDGAR F.) and CLAUDE DUGAN. Esters of Tungstic acid	i, 76
BARR (EDWIN DE). Action of Water on certain Fatty acids	i, 76
CLARKE (CHARLES F.) and EDGAR F. SMITH. Electrolytic Oxidation of Succinic acid	i, 77
RUFF (OTTO) and GERHARD OLLENDORFF. Separation and Purification of Sugars	i, 77
POTTEVIN (HENRI). Isomaltose	i, 77
BAU (ARMINIUS). Crystallised Melibiose	i, 77
TANRET (CHARLES) and GEORGES TANRET. Rhamnose	i, 78
SYNIEWSKI (WIKTOR). Constitution of Starch	i, 78
RODEWALD (HERMANN) and A. KATTEIN. Preparation of Starch Solutions and separation of Starch Granules from such Solutions	i, 79
POTTEVIN (HENRI). Saccharification of Starch	i, 80
POTTEVIN (HENRI). Maltodextrin	i, 81
GAUTIER (ARMAND [ÉMILE JUSTIN]). Preparation and estimation of Glycogen	i, 81
RÖSER and PUAUX. Composition of the Gum of <i>Grevillea robusta</i>	i, 82
LUCAS (AD.). Nitroacetone	i, 82
SOLOMINA (WASSILY). γ -Amino- $\beta\beta$ -dimethylbutane	i, 82
CLARKE (THOMAS). β -Heptylamine	i, 83
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Behaviour of Diamines on Neutralisation	i, 83
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Diamines. Diethylene-diamine (Piperazine)	i, 83
AUWERS (KARL) [with FRITZ MAYER and F. SCHLEICHER]. Amic acids and Imides of Aliphatic Dicarboxylic acids	i, 84
SCHIFF (HUGO). Methylenearparagine and allied compounds	i, 85
HANTZSCH (ARTHUR [RUDOLF]). Nitrosoalkylurethanes	i, 86
WERNER (ALFRED), F. BRÄUNLICH, R. KLIEN, and HERBERT MÜLLER. Constitution of Inorganic compounds. XX. Thiocyanocobalt salts and structural Isomerides	i, 86
DENIGÈS (GEORGES). Organomercuric compounds	i, 89
SMITH (EDGAR F.), E. A. BARNETT, and CLARENCE HALL. Tungsten Alkyls	i, 89
KURSANOFF (N.). Cyclic compounds. Ethylhexanaphthene and Mercuro-heptanaphthene Iodide	i, 89
HANTZSCH (ARTHUR) and HERMANN KISSEL. Derivatives of Nitroic acids and reactions of Nitro-compounds	i, 89
LEMOINE (GEORGES). Transformation of Styrene into Metastyrene under the influence of Light	i, 91
ERDMANN (HUGO). Naphthalene-1 : 3 : 5-trisulphonic acid	i, 91
ODDO (GIUSEPPE). Polymerisation of Inorganic Chloro-anhydrides	i, 92
COHN (GEORG). Salicylanilinoacetic acid (<i>o</i> -Carboxyphenylglycollic acid monoanilide) and its derivatives	i, 93
GNEHM (ROBERT) and H. WERDENBERG. Diphenylamine derivatives, especially Sulphonic acids	i, 93
HANTZSCH (ARTHUR [RUDOLF]). Characterisation of Weak acids and Pseudo-acids	i, 94
AUWERS (KARL). Bromophenols insoluble in Alkalis	i, 96
AUWERS (KARL). Bromophenols from <i>as-o</i> -Xylenol and <i>as-m</i> -Xylenol	i, 96
AUWERS (KARL) and W. HAMPE. Pentabromide from [Pentabromo-derivative of] <i>as-m</i> -Xylenol	i, 96
AUWERS (KARL) and R. FREIHERR VON ERGGELET [and in part H. VAN DE ROVAART and W. WOLFF]. Pentabromo-derivative of <i>as-o</i> -Xylenol	i, 97
AUWERS (KARL) and HARRY BURROWS [and in part H. VAN DE ROVAART]. Heptabromo-derivative of <i>as-o</i> -Xylenol	i, 98

	PAGE
MOUREU (CHARLES). Catechol derivatives	i, 99
VORLÄNDER (DANIEL). Hydrogenised derivatives of Diphenylmethane and Triphenylmethane	i, 99
VORLÄNDER (DANIEL) and FRITZ KALKOW. Formaldehyde derivative of Dihydroresorcinol	i, 99
VORLÄNDER (DANIEL) and O. STRAUSS. Compounds of Dihydroresorcinol with Aromatic Aldehydes	i, 100
MARCHLEWSKI (LEO). Tautomerisation of Isatin	i, 100
WEINER (ALFRED) and H. E. CONRAD. Optically active <i>trans</i> -Hexahydro-phthalic acid	i, 100
FRANCESCONI (LUIGI). Constitution of Santonic and Metasantonic acids and of Metasantonin	i, 101
POND (F. J.), O. P. MAXWELL, and G. M. NORMAN. Action of Sodium Methoxide on Dibromides of Propenyl compounds and of Unsaturated acids	i, 102
FARMER (ROBERT C.) and ARTHUR HANTZSCH. α -Oximinoketones and Quinoneoximes as Pseudo-acids	i, 103
MORGAN (WILLIAM CONGER). Space Isomerism of the Ethers of Tolu-quinoneoxime	i, 103
KONDAKOFF (IWAN L.) and EUGEN LUTSCHININ. Isomerism in the Menthol Series	i, 104
ZAHARIA (AL. J.). Solubility of Camphor in Hydrochloric acid	i, 106
SCHREINER (OSWALD) and EDWARD KREMERS. Nitroso-derivatives of Caryophyllene and Cadinene and their bearing on the Characterisation and Classification of the Sesquiterpenes	i, 106
ALPERS (WILLIAM C.). Oil and Terpenes from <i>Aralia nudicaulis</i>	i, 107
HAENSEL (HEINRICH). Liquorice Oil	i, 107
FICHTER (FRITZ) and E. KATZ. Ethereal Oil of Poplar Buds	i, 108
BEYERINOK (MARTINUS WILLEM). Glucosides and Enzymes contained in the root of some <i>Spiræas</i>	i, 108
SILLEVOLDT (H. E. TH. VAN). Derride and Pachyrhizide, Indian Fish Poisons	i, 109
BODE (G.). Chlorophyll	i, 109
BODE (G.). Phylloxanthin	i, 109
ANDRÉK (KARL). Furfuraldehyde from Beetroot and Molasses	i, 110
SCHULZE (ERNST) and ERNST WINTERSTEIN. Constitution of Arginine	i, 110
LAWROFF (D.). Benzoyl Compound of Hexon Bases	i, 110
PICCININI (ANTONIO). An Alkaloid contained in the Bark of the Pomegranate	i, 110
FENNER (GOTTFRIED) and JULIUS TAFEL. Abnormal Aurichlorides of Organic Bases	i, 111
GUARESCHI (ICILIO) and ERNESTO GRANDE. Synthesis of Glutaric and Trimethylene derivatives	i, 111
GUARESCHI (ICILIO) and ERNESTO GRANDE. Action of Heat on Hydrogenised compounds	i, 112
HANTZSCH (ARTHUR) and M. KALB. Pseudo-ammonium bases	i, 113
CAMPS (RUDOLF). Synthesis of 2- and 4-Hydroxyquinolines	i, 116
TRAUBE (WILHELM) and H. W. F. LORENZ. Carbamide and Thiocarbamide derivatives of Diacetoneamine	i, 115
TRAUBE (WILHELM) and RUDOLF SCHWARZ. Action of Amidines on Mesityl Oxide and Phorone	i, 116
TRAUBE (WILHELM) and MAX SCHALL. Carbamide and Guanidine derivatives of Diacetoneamine	i, 118
TRAUBE (WILHELM) and A. EYME. Additive Products of the Carbo-diimides	i, 118
HENZE (MARTIN). Preparation of Phenylindoxyl	i, 119
GREEN (ARTHUR GEORGE). Orthoquinonoid Structure of Safranin, Oxazine, and Thiazine Colouring Matters	i, 119
BEHREND (ROBERT) and EMIL DIETRICH. Constitution of δ -Methyluric acid	i, 120

	PAGE
TAFEL (JULIUS). Deoxytheobromine	i, 121
BAILLIE (THOMAS B.) and JULIUS TAFEL. Deoxycaffeine	i, 121
FARMER (ROBERT C.) and ARTHUR HANTZSCH. Constitution of the so-called Oxyazo-compounds	i, 122
McPHERSON (WILLIAM). Constitution of the Hydroxyazo-compounds	i, 123
FREER (PAUL C.). Action of Benzoyl Chloride on the Phenylhydrazones of Benzoin	i, 124
LABHARDT (HANS) and K. VON ZEMBRZUSKI. Asymmetrical Disubstituted Hydrazones	i, 125
HANTZSCH (ARTHUR [RUDOLF]). Normal Diazo-compounds as "Pseudo-diazonium compounds"	i, 126
BOKORNY (THOMAS). Decomposition of Proteids by acids	i, 126
REACH (FELIX). Amount of Tyrosine from Proteids	i, 126
PANORMOFF (ALEXEI A.). Nomenclature of the Albumins of White of Egg	i, 126
PANORMOFF (ALEXEI A.). Action of Heat, Dilute acids, and Alcohol on Albumin	i, 127
MARCUS (EMIL). Solubility of Serum Globulin in Water	i, 127
ARNOLD (V.). Spectroscopy of the Blood	i, 127
SIEGFRIED (MAX). Extractives of Muscle	i, 127
KRÜGER (TH. RICHARD). Nucleons	i, 128
ASCOLI (ALBERTO). Plasmic acid	i, 128
MÖRNER (CARL THORE [GRAF]). Preparation of Gelatin	i, 128
MÖRNER (KARL AXEL HAMPUS). Cystin, a Decomposition Product of Keratin	i, 128

PART II.

General and Physical Chemistry.

KOHLRAUSCH (FRIEDRICH) and MARGARET E. MALTBY. Electrical Conductivity of Alkali Chlorides and Nitrates	ii, 61
LORENZ (RICHARD). Change of Free Energy in fused Halogen compounds of some Heavy Metals	ii, 61
WHETHAM (W. C. DAMPIER). Coagulative Power of Electrolytes	ii, 62
MACGREGOR (JAMES G.). Application of the Dissociation Theory to the Electrolysis of Aqueous Solutions of two Electrolytes with one Common Ion	ii, 62
LEHFELDT (R. A.). Theory of the Electrolytic Solution Pressure	ii, 62
SMOLUCHOWSKI R. VON SMOLAN (M.). Thermal Conductivity in Gases	ii, 63
WREWSKY (M.). Thermal Capacity and Colour of Solutions of Cobalt Chloride	ii, 63
BIRON (EUGEN VON). Thermal Capacity of Solutions of Sulphuric acid	ii, 63
HAYWOOD (JOHN K.). Some Boiling Point Curves. II.	ii, 64
RYLAND (GARNETT). Liquid Mixtures of Constant Boiling Point	ii, 64
ROOZEBOOM (HENDRIK WILLEM BAKHUIS). Melting Points in Systems of Optical Isomerides	ii, 64
DAHMS (ALBERT). Freezing Point of Mixtures of Acetic acid and Water	ii, 65
COPPET (LOUIS CASIMIR DE). Freezing Point of Mixtures of Acetic acid and Water	ii, 65
ARCHIBALD (E. H.). Test by Freezing Point Determinations of the Dissociation Values obtained by the Conductivity Method in the case of Solutions of Potassium and Sodium Sulphates	ii, 65
GARELLI (FELICE) and F. CALZOLARI. Cryoscopic behaviour of Substances with Constitution similar to that of the Solvent	ii, 65

	PAGE
AUWERS (KARL) [with W. BARTSCH and H. M. SMITH]. Influence of the Solvent on the Cryoscopic behaviour of Phenols	ii, 66
GALITZKI (N.). Influence of the Medium on the Heats of Solution of salts DIETERICI (KONRAD). The Critical State	ii, 66
LEY (HEINRICH). Hydrolytic Dissociation in Salt Solutions	ii, 67
AIGNAN (A.) and E. DUGAS. Determination of the Solubility Coefficients of Liquids	ii, 68
HRZ (W.). Equilibrium between Manganous salts and Ammonia	ii, 68
KÜSTER (FRIEDRICH WILHELM) and A. THIEL. Fusion of Sodium Thio-sulphate: Hydrates	ii, 68
HANTZSCH (ARTHUR) and F. SEBALDT. Molecular state of Ammonia and of Amines in Aqueous Solutions	ii, 69
ROOZEBOOM (HENDRIK WILLEM BAKHUIS). Conversion of Mixed Crystals into a compound	ii, 70
REINDERS (W.). Mixed Crystals of Mercuric Iodide and Bromide	ii, 70
TECLU (NICOLA). Properties of Flames	ii, 71
HOPKINS (ARTHUR JOHN). A Dissolver	ii, 71
TIXIER (A.). Biological and Chemical Purification of Water	ii, 71

Inorganic Chemistry.

TECLU (NICOLA). New Ozone Apparatus	ii, 72
EDER (JOSEF MARIA) and EDUARD VALENTA. Spectrum of Chlorine	ii, 72
SARLES (E. H.). Colour of Chlorine Solutions	ii, 72
FOERSTER (FRITZ). Theory of the Electrolytic Formation of Hypochlorite and Chlorate	ii, 72
MÜLLER (ERICH). Formation of Hypochlorite and Chlorate in the Electrolysis of Alkali Chlorides	ii, 73
ODDO (GIUSEPPE) and E. SERRA. Molecular Weights of some Elements and their derivatives	ii, 73
ODDO (GIUSEPPE) and E. SERRA. Action of Arsenious and Antimonious oxides on Sulphur Monochloride	ii, 74
BIRON (EUGEN VON). Hydrates of Sulphuric acid	ii, 74
ODDO (GIUSEPPE) and E. SERRA. Polymerisation of Inorganic Chloro-anhydrides. I.	ii, 74
BOGUSKI (JOSEF JURI). Properties of Solutions of Sodium Nitrite	ii, 75
GRAEFE (EDMUND) and MORITZ ECKARDT. Preparation of Cesium from the Carbonate	ii, 75
MOISSAN (HENRI). Calcium and its compounds	ii, 76
ZULKOWSKI (KARL). Setting of Gypsum	ii, 76
JABOIN (A.). Preparation and Properties of Crystallised Barium and Strontium Phosphides	ii, 76
HOFF (JACOBUS H. VAN'T) and H. M. DAWSON. Formation of Oceanic salt deposits particularly of the Stassfurt beds. XIV. Influence of pressure on the formation of Tachyhydrite	ii, 76
LIDOFF (ALEXANDER P.). Solution of Copper in Gelatin Solution	ii, 77
MEYER (RICHARD JOS.) and HANS BEST. Manganese Trichloride and Tetrachloride	ii, 77
RICHARDS (THEODORE WILLIAM) and GREGORY PAUL BAXTER. Atomic Weight of Cobalt. III. Analysis of Cobaltous Chloride and Oxide	ii, 78
BAXTER (GREGORY PAUL). Occlusion by Hydrogen, by Cobalt and other Metals	ii, 78
MEYER (RICHARD JOS.) and HANS BEST. Chromyl Chloride, Chloro-chromic acid, and Aminochromic acid	ii, 79
REGELSBERGER (FRIEDRICH [FERD.]). Recovery of Chromic acid from Chromium residues	ii, 79
STAVENHAGEN (ALFRED). Preparation of Molybdenum and Uranium with the aid of Liquid Air	ii, 80
GUICHARD (MARCEL). Molybdenum Dioxide	ii, 80

	PAGE
STAVENHAGEN (ALFRED). Preparation of Tungsten with the aid of Liquid Air	ii, 80
SMITH (EDGAR FRANCIS). Tungsten	ii, 80
SMITH (EDGAR F.) and WILLETT L. HARDIN. Atomic Weight of Tungsten	ii, 80
SMITH (EDGAR F.) and HERMANN FLECK. Action of Sulphur Monochloride on Tungsten Trioxide	ii, 81
CURIE (SKŁODOWSKA). Rays emitted by Uranium and Thorium compounds	ii, 81
CURIE (P.) and SKŁODOWSKA CURIE. New Radio-active Substance contained in Pitchblende	ii, 82
CURIE (P.), SKŁODOWSKA CURIE, and GUSTAVE BÉMONT. An extremely Radio-active Substance contained in Pitchblende	ii, 82
DEMARÇAY (EUGENE). Spectrum of a Radio-active Substance [in Barium Chloride]	ii, 83
DEMARÇAY (EUGENE). Spectrum of Radium	ii, 83
CURIE (SKŁODOWSKA). Atomic Weight of the Metal in Radio-active Barium Chloride	ii, 83
COHEN (ERNST) and C. VAN EYCK. Enantiotropy of Tin	ii, 83
POUGET (ISIDORE). Thio- and Seleno-antimonites	ii, 84
HARDIN (WILLETT LEPLEY). Derivatives and Atomic Weight of Palladium	ii, 85

Mineralogical Chemistry.

GOMES (JACINTO PEDRO). Libollite	ii, 86
RAYMOND (ROSSITER WORTHINGTON). Limonite Pseudomorphs from Dutch Guiana	ii, 86
MAYNARD (GEORGE W.). Chromite from Newfoundland	ii, 86
ASCHERMANN (O. H.). Occurrence of Nickel in Silesia	ii, 86
TERMIER (PIERRE). Leverrierite	ii, 86
JIMBO (KOTORA). Minerals of Japan	ii, 87
PENFIELD (SAMUEL L.) and CHARLES HYDE WARREN. New Minerals from Franklin, New Jersey	ii, 88
GLINKA (KONSTANTIN [D.]). Hydrated Aluminium Silicates and Clays	ii, 89
HUTCHINSON (ARTHUR). Stokesite, a new Mineral from Cornwall	ii, 89
GREGORY (HERBERT E.). Andesites from Maine	ii, 90
LUDWIG (ERNST) and THEODOR PANZER. Hot Sulphur Springs of Deutsch-Altenburg	ii, 90
NUSSBERGER (GUSTAV). Origin of Graubünden Mineral Waters	ii, 90
DAMBERGIS (ANASTASIOS K.). Mineral Waters of Lutraki, Greece	ii, 90
ALBERTONI (PIETRO) and GIUSTO CORONEDI. The Water of Monsumano	ii, 90

Physiological Chemistry.

RACHFORD (BENJAMIN KNOX). Influence of Bile, of Acid, and of Alkalis on the Proteolytic Action of Pancreatic Juice	ii, 91
STRAUB (WALTHER). Influence of Removal of Water on Metabolism and Circulation	ii, 91
PFLÜGER (EDUARD [FRIEDRICH WILHELM]). Influence of the kind and amount of Nutriment on Metabolism	ii, 91
MILROY (T. H.) and J. MALCOLM. Metabolism of Nucleins	ii, 91
ROSEMAN (RUDOLF). The Proteid-sparing action of Alcohol	ii, 92
WESNER (JOHN A.). Koppe's Theory of the formation of Hydrochloric acid in the Stomach	ii, 92
PFLÜGER (EDUARD [FRIEDRICH WILHELM]). Origin of Fat from Proteid	ii, 92
MACLEOD (J. J. R.). Phosphorus in Muscle	ii, 92
BUNGE (GUSTAV VON). Sodium Chloride in Cartilage	ii, 92
WEINLAND (ERNST). The Lactase of the Pancreas	ii, 93

	PAGE
VIRCHOW (C.). Retention of Phytosterol in the Animal Body after feeding with Cotton-seed Oil	ii, 93
SÜSS (P.). Albumin in the Cell of the Queen Bee	ii, 93
KLETT (A.). Albumin in the Cell of the Queen Bee	ii, 93
VERNON (HORACE MIDDLETON). Death Temperature of Marine Organisms	ii, 93
KRÜGER (MARTIN). Degradation of Caffeine in the Organism of the Dog	ii, 93
KATSUYAMA (K.), T. KUWAHARA, and K. SENO. Influence of Theine on the Excretion of Alkalies	ii, 94
GREGOR (A.). Estimation of the Reducing Substances in Urine by Peške's Method	ii, 94
HÉDON (E.) and J. ARROUS. Relations between the Diuretic Effects and Osmotic Properties of Sugars	ii, 94
SABBATANI (LUIGI) [Physiological action of] Cyanotetramethylpyridone	ii, 94
BRAHM (CARL). Physiological action of Quinose [o-Hydroxyquinoline-sulphonic acid]. Formation of conjugated Glycuronic acids	ii, 95
TIMOFEEFFSKY (DMITRI J.). Action of Lymphagogues on the Proteids of Blood and Lymph	ii, 95
GRÉHANT (NESTOR). Acute Alcoholism: Estimation of Alcohol in the Blood and Tissues	ii, 95
GUILLERY. Effect of Poisons on the Eye-Muscles	ii, 95

Chemistry of Vegetable Physiology and Agriculture.

STOKLASA (JULIUS). Do the Bacteria of Alinit assimilate Atmospheric Nitrogen?	ii, 96
WINOGRADSKY (SERGEI) and V. OMELIANSKY. Influence of Organic Substances on the Work of Nitrifying Organisms	ii, 96
OMELIANSKY (V.). Nitrification of Organic Nitrogen	ii, 97
STUTZER (ALBERT) and R. HARTLEB. Micro-organisms observed in the Formation of Nitrates	ii, 97
GRIMBERT (LÉON). Action of <i>Bacillus coli</i> and <i>B. d'Eberth</i> on Nitrates	ii, 97
WOLFF (KURT). Denitrification	ii, 98
STOKLASA (JULIUS). Which Forms of Carbohydrates do Denitrification Bacteria require for their Vital Processes?	ii, 98
BAU (ARMINIUS). Fermentation Experiments with Trehalose	ii, 98
NEWCOMBE (FREDERICK C.). Cellulose Enzymes	ii, 99
GILLOT (HENRI). Raffinose as a Constituent of Carbohydrate for the Nutrition of <i>Aspergillus niger</i>	ii, 99
LUTOSLAWSKI (JAN). Nitrogen Nutrition of Leguminous Plants	ii, 99
SOSNOWSKI (JAN). Chemistry of the Cell	ii, 100
BOURCET (PAUL). Absorption of Iodine by Plants	ii, 100
STOKLASA (JULIUS). Physiological Importance of Furfuroids in Sugar Beet	ii, 100
MOLISCH (HANS). Occurrence of Indican in the Chlorophyll Grains of the Indigo Plant	ii, 101
SCHULZE (ERNST) and ERNST WINTERSTEIN. Histidine and Lysine in the Decomposition Products of Conifer Seeds	ii, 101
SCHULZE (ERNST). Histidine and Lysine in Seedlings	ii, 101
CHARABOT (EUGÈNE). Progressive Development of Essence of Bergamot	ii, 101
HANUS (JOS.). Hazel Nut Oil	ii, 101
DRIESSEN MAREEUW (W. P. H. VAN DEN). Cortex Lokri	ii, 102
SHERMAN (P. L.) and C. H. BRIGGS. Saw Palmetto	ii, 102
CORNU (CHARLES). Presence of an Oxidising Enzyme in the Vine	ii, 102
MAECKER (MAX [HEINRICH]). Accumulation of Nitrogen by the Cultivation of Intermediate Crops on Loamy Soil	ii, 102
SEMPOLOWSKI (A.). Experiments with Different Lupins	ii, 103
ALBERT (FRIEDRICH). [Experiments with] Cows at Lauchstädt, 1896—1897	ii, 103

	PAGE
RAMM (EBERH.) and E. MÖLLER. Experiments on Feeding Cows with Brewery Residues	ii, 104
INMENDORFF (HEINRICH). Amounts of Plant Food withdrawn from Peaty and Sandy Soil by cutting Heather and Turf	ii, 104
WHEELER (HOMER J.), C. L. SARGENT, and B. L. HARTWELL. Amount of Humus in Soils, and the Percentage of Nitrogen in the Humus as affected by the Application of Air, Slaked Lime, and other Substances	ii, 104
MAERCKER (MAX) and W. SCHNEIDEWIND. Losses of the Nitrogen of Stable Manure in Covered and Uncovered Stalls	ii, 105
SCHNEIDEWIND (W.). Conservation of Manure	ii, 105
PARIS (GIULIO). Bat Guano found at Cagliari, Sardinia	ii, 106
BÖTTCHER (O.). Value of Lime compounds in Phosphatic Manures	ii, 106

Analytical Chemistry.

MUTSCHLER (L.). Estimation of Oxygen Dissolved in Water	ii, 106
MOORE (M. J.). Estimation of Sulphur in Pig Iron	ii, 106
FRIEDLÄNDER (SIEGFRIED). Estimation of Sulphur in Petroleum	ii, 107
LIDORFF (ALEXANDER P.). Estimation of Sulphur in Naphtha	ii, 107
HENRIQUES (ROBERT). Estimation of Sulphur in Organic Substances	ii, 107
TAUBER (ERNST). Detection of Nitrogen in Organic compounds containing Sulphur	ii, 107
POOL (J. F.). New Method for Estimating Nitric acid	ii, 107
GERHARDT (D.). Estimation of Phosphorus by L. Reed's method	ii, 108
MARIE (CH.). Estimation of Phosphorus in Organic compounds	ii, 108
KÜSTER (FRIEDRICH WILHELM). Separation of Barium, Strontium, and Calcium by mixed Carbonate and Sulphate Solutions of varying Composition	ii, 108
NEUBAUER (HUGO). Composition of Ammonium Magnesium Phosphate	ii, 108
GOOCH (FRANK A.) and MARTHA AUSTIN. Composition of Ammonium Magnesium Phosphate	ii, 108
NISSENSON (H.). Analysis of "Weissmetall"	ii, 108
FERNBERGER (HARRY M.) and EDGAR F. SMITH. Electrolysis of Metallic Phosphate Solutions	ii, 109
FOMIN (A.). Analysis of Bronzes	ii, 109
REICHARD (C.). Estimation of Manganic acids in the presence of Manganese salts or of both Manganese compounds in presence of each other by means of an Alkaline Solution of Arsenious acid	ii, 109
DÖHLER (E.). Estimation of Chromium in Iron and Steel	ii, 110
MAHON (R. W.). Estimation of Chromium in Steel	ii, 110
LEYS (ALEXANDRE). Detection of Alkali Chromates	ii, 110
GOOCH (FRANK A.) and FREDERICK H. MORLEY. Iodometric estimation of Gold	ii, 110
PKIWOZNIK (EDUARD). Parting of Gold-Platinum Alloy	ii, 111
SHUTTLEWORTH (A. E.) and BERNHARD TOLLENS. Method and Apparatus for incinerating Vegetable and Animal substances	ii, 111
GRAS (OTTO) and WILHELM GINTL, jun. Application of the Kjeldahl method of destroying Organic matter in the Detection of Metals	ii, 111
RIECHELMANN (RUDOLF). Estimation of Ferrocyanides in Spent Gas-Purifying Material	ii, 111
WOLFF (JULES). Improvement in Trillat's Process for the Detection of Methyl Alcohol in Alcohols	ii, 111
GRÉHANT (NESTOR). Estimation of Alcohol in Blood and Tissues	ii, 112
VAUBEL (WILHELM). Bromination of Phenols	ii, 112
RIEGLER (E.). Estimation of Carbolic acid and other Phenols	ii, 112
CHAILLE (PH.). New Method for the Gravimetric Estimation of Sugars	ii, 112
PELLET (HENRI). Influence of Lead Acetate and Basic Acetate on the Estimation of Reducing Sugars in Wipes and Lees	ii, 113

PELLET (HENRI). Estimation of Sugar in Urine	ii, 113
JESSEN-HANSEN (H.). Estimation of Invert Sugar in the presence of Sucrose	ii, 113
BRUYLANTS (GUSTAVE) and H. DRUYTS. Estimation of Starch in Yeast	ii, 113
GAUTIER (ARMAND). Estimation of Glycogen	ii, 113
ARNOLD (V.). Detection of Acetic acid in Urine	ii, 113
MAINSBRÉCQ (V.). Estimation of the insoluble Fatty acids in Butter and the cause of Differences in the Results	ii, 114
LABORDE (J. [B. VINCENT]) and L. MOREAU. Estimation of Succinic acid in Fermented Liquids	ii, 114
WOLFF (JULES). Colour Reaction for Tartaric acid and its compounds	ii, 115
VITALI (DIOSCORIDE). Detection of Urochloralic acid in Urine after Ad- ministration of Chloral Hydrate, especially in cases of Poisoning	ii, 115
TAYLOR (ALONZO ENGLEBERT). Modified Soxhlet Apparatus for the Ex- traction of Fats from Liquids	ii, 115
INDEMANS (W. G.). Butter and Butter Substitutes	ii, 115
BROWNE (C. A., jun.). Rancidity in Butter Fat	ii, 115
ENGELN (ALPH. VAN). The Becchi Test	ii, 116
SOLTSIEN (PAUL). Becchi's Test for Cotton-seed Oil	ii, 116
KERP (WILHELM). Baudouin's Reaction	ii, 116
BELLIER (J.). Colour Test for Sesamé Oil, and three new characteristic Tests	ii, 117
WINTGEN (M.). Estimation of Formaldehyde in the Air	ii, 117
ISTRATI (CONSTANTIN I.). Detection of Aldehydes in Alcohols	ii, 117
ALDEN (F. W.) and S. NOLTE. Estimation of Carvone in Volatile Oils. III.	ii, 117
DIETERICH (KARL). Examination of Resins. X. Storax	ii, 118
EVERS (FERD.). Testing Storax	ii, 118
DIETERICH (KARL). Estimation of Resins. XI. Anime, Caranna, Dammur, Labdanum, Mastic, Sandarac, Tacamahaca, and Turpeth	ii, 118
DIETERICH (KARL). Estimation of Resins. XII. Ammoniacum, Bdellium, Galbanum, Opoponax, and Sagapenum	ii, 118
RÖSSING (R.). Detection of "Saccharin" in Beer	ii, 119
WOLFF (JULES). Colour reaction for the Detection of Benzidine and Tolidine	ii, 119
GORDIN (HARRY MANN). Simple Alkalimetric Method for the Estimation of salt-forming Alkaloids with the aid of Phenolphthalein as indicator	ii, 119
MECKE. Alkaloid resembling Aconitine found in a corpse	ii, 120
ARCHETTI (ANDREA). Delicate Test for Caffeine	ii, 121
MUSSET (FRANZ). Estimation of Cornutine	ii, 121
KOBBERT (RUDOLF). Recognition of Morphine and its derivatives	ii, 121
RUSSWURM. Estimation of Chloral Hydrate and Morphine in Organs	ii, 121
THAETER (KARL). Estimation of Santonin in the Flower Buds of <i>Artemisia maritima</i>	ii, 122
WANG (EYVIN). Estimation of Urinary Indican	ii, 122
IMBERT (HENRI) and A. ASTRUC. Volumetric estimation of Sodium Cacodylate	ii, 122
WILEY (HARVEY WASHINGTON). Separation of Proteids from Flesh bases	ii, 122
DEROIDE (E.) and OUL. Source of Error in testing for Albumin in Urine	ii, 123
STRZYŻOWSKI (CASIMIR). Microchemistry of Crystalline Hæmatin com- pounds. Detection of Blood	ii, 123
MECKE. Detection of Yolk of Egg in Margarine	ii, 123
ÄLDOR (LUDWIG VON). Detection of Albumoses in Urine	ii, 123
HENRIQUES (ROBERT). Analysis of Rubber Wares	ii, 124

INDEX OF AUTHORS' NAMES.

A.

Adie, R. H., and K. C. Browning,
TRANS., 150.
Aignan, A., and E. Dugas, ii, 68.
Albert, F., ii, 103.
Albertoni, P., and G. Coronedi,
ii, 90.
Alden, F. W., and S. Nolte, ii, 117.
Aldor, L. von, ii, 123.
Alpers, W. C., i, 107.
Andrlík, K., i, 110.
Archetti, A., ii, 121.
Archibald, E. H., ii, 65.
Arnold, V., i, 127; ii, 113.
Arrous, J. See E. Hédon.
Aschermann, O. H., ii, 86.
Ascoli, A., i, 128.
Astruc, A. See H. Imbert.
Austin, M. See F. A. Gooch.
Auwers, K., i, 96.
Auwers, K., W. Bartsch, and H. M.
Smith, ii, 66.
Auwers, K., H. Burrows, and H.
van de Roovaart, i, 98.
Auwers, K., R. F. von Erggelet, H.
van de Roovaart, and W. Wolff,
i, 97.
Auwers, K., and W. Hampe, i, 96.
Auwers, K., F. Mayer, and F.
Schleicher, i, 84.

B.

Baillie, T. B., and J. Tafel, i, 121.
Baldwin, de F. See F. A. Gooch.
Barnett, E. A. See E. F. Smith.
Barr, E. de, i, 76.
Bartsch, W. See K. Auwers.
Bau, A., i, 77; ii, 98.
Baxter, G. P., ii, 78.
Baxter, G. P. See T. W. Richards.
Behrend, R., and E. Dietrich, i, 120.

Bellier, J., ii, 117.
Bémont, G. See P. Curie.
Berthelot, M. P. E., i, 83.
Best, H. See R. J. Meyer.
Beyerinck, M. W., i, 108.
Biron, E. von, ii, 63, 74.
Bode, G., i, 109.
Böttcher, O., ii, 106.
Boguski, J. J., ii, 75.
Bokorny, T., i, 126.
Bourcet, P., ii, 100.
Bräunlich, F. See A. Werner.
Brahm, C., ii, 95.
Briggs, C. H. See P. L. Sherman.
Browne, C. A., jun., ii, 115.
Browning, K. C. See R. H. Adie.
Bruylants, G., and H. Druyts,
ii, 113.
Bunge, G. von, ii, 92.
Burrows, H. See K. Auwers.

C.

Calzolari, F. See F. Garelli.
Camps, R., i, 115.
Cavalier, J., i, 75.
Chapelle, P., ii, 112.
Charabot, E., ii, 101.
Charitschkoff, K. W., i, 74.
Chattaway, F. D., and K. J. P. Orton,
TRANS., 134.
Clarke, C. F., and E. F. Smith,
i, 77.
Clarke, T., i, 83.
Cohen, E., and C. van Eyck, ii, 83.
Cohn, G., i, 93.
Conrad, H. E. See A. Werner.
Coppet, L. C. de, ii, 65.
Cornu, C., ii, 102.
Coronedi, G. See P. Albertoni.
Curie, P., and S. Curie, ii, 82.
Curie, P., S. Curie, and G. Bémont,
ii, 82.
Curie, S., ii, 81, 83.

D.

Dahms, A., ii, 65.
 Dambergis, A. K., ii, 90.
 Dawson, H. M. See J. H. van't Hoff.
 Dean, G., *TRANS.*, 117.
 Demarcay, E., ii, 83.
 Denigès, G., i, 89.
 Deroide, E., and Oui, ii, 123.
 Dieterich, K., ii, 118.
 Dieterich, K., ii, 67.
 Dietrich, E. See R. Behrend.
 Döhler, E., ii, 110.
 Driessen Mareeuw, W. P. H. van, ii, 102.
 Druyts, H. See G. Bruylants.
 Dugan, C. See E. F. Smith.
 Dugas, E. See A. Aignan.

E.

Eckardt, M. See E. Graefe.
 Eder, J. M., and E. Valenta, ii, 72.
 Engelen, A. van, ii, 116.
 Erdmann, H., i, 91.
 Erggelet, R. F. von. See K. Auwers.
 Evers, F., ii, 118.
 Eyck, C. van. See E. Cohen.
 Eyme, A. See W. Traube.

F.

Farmer, R. C., and A. Hantzsch, i, 103, 122.
 Fenner, G., and J. Tafel, i, 111.
 Fernberger, H. M., and E. F. Smith, ii, 109.
 Fichter, F., and E. Katz, i, 108.
 Fleck, H. See E. F. Smith.
 Foerster, F., ii, 72.
 Fomin, A., ii, 109.
 Francesconi, L., i, 101.
 Freer, P. C., i, 124.
 Friedländer, S., ii, 107.

G.

Galitzki, N., ii, 66.
 Garelli, F., and F. Calzolari, ii, 65.
 Gautier, A., i, 81; ii, 118.
 Gerhardt, D., ii, 108.
 Gillot, H., ii, 99.
 Gintl, W., jun. See O. Gras.
 Glinka, K. D., ii, 89.
 Gnehm, R., and H. Werdenberg, i, 93.
 Gomes, J. P., ii, 86.

Gooch, F. A., and M. Austin, ii, 108.
 Gooch, F. A., and De F. Baldwin, i, 74.
 Gooch, F. A., and F. T. Morley, ii, 110.
 Gordin, H. M., ii, 119.
 Graefe, E., and M. Eckardt, ii, 75.
 Grande, E. See I. Guareschi.
 Gras, O., and W. Gintl, jun., ii, 111.
 Green, A. G., i, 119.
 Gregor, A., ii, 94.
 Gregory, H. E., ii, 90.
 Gréhant, N., ii, 95, 112.
 Grimbert, L., ii, 97.
 Guareschi, I., and E. Grande, i, 111, 112.
 Guédras, M., i, 75.
 Guichard, M., ii, 80.
 Guillery, ii, 95.

H.

Haensel, H., i, 107.
 Hall, C. See E. F. Smith.
 Hampe, W. See K. Auwers.
 Hantzsch, A., i, 86, 94, 126.
 Hantzsch, A., and M. Kalb, i, 113.
 Hantzsch, A., and H. Kissel, i, 89.
 Hantzsch, A., and F. Sebaldt, ii, 69.
 Hantzsch, A. See also R. C. Farmer.
 Hanuš, J., ii, 101.
 Hardin, W. L., ii, 85.
 Hardin, W. L. See E. F. Smith.
 Hartleb, R. See A. Stutzer.
 Hartwell, B. L. See H. J. Wheeler.
 Haywood, J. K., ii, 64.
 Hédon, E., and J. Arrous, ii, 94.
 Henriques, R., ii, 107, 124.
 Henze, M., i, 119.
 Herz, W., ii, 68.
 Hoff, J. H. van't, and H. M. Dawson, ii, 76.
 Hopkins, A. J., ii, 71.
 Hutchinson, A., ii, 89.

I.

Imbert, H., and A. Astruc, ii, 122.
 Immendorff, H., ii, 104.
 Indemans, W. G., ii, 115.
 Istrati, C. I., ii, 117.

J.

Jaboin, A., ii, 76.
 Jackson, H., *TRANS.*, 129.

Jessen-Hansen, H., ii, 113.
 Jimbo, K., ii, 87.

K.

Kalb, M. See A. Hantzsch.
 Kalkow, F. See D. Vorländer.
 Katsuyama, K., T. Kuwahara, and K. Seno, ii, 94.
 Katteian, A. See H. Rodewald.
 Katz, E. See F. Fichter.
 Kerp, W., ii, 116.
 Kissel, H. See A. Hantzsch.
 Klein, R. See A. Werner.
 Klett, A., ii, 93.
 Kobert, R., ii, 121.
 Kohlrausch, F., and M. E. Maltby, ii, 61.
 Kondakoff, I. L., and E. Lutschinin, i, 104.
 Krämer, G., and A. Spilker, i, 73.
 Kremers, E. See O. Schreiner.
 Krüger, M., ii, 93.
 Krüger, T. R., i, 128.
 Küster, F. W., ii, 103.
 Küster, F. W., and A. Thiel, ii, 68.
 Kursanoff, N., i, 89.
 Kuwahara, T. See K. Katsuyama.

L.

Labhardt, H., and K. von Zembrzusi, i, 125.
 Laborde, J., and L. Moreau, ii, 114.
 Lawroff, D., i, 110.
 Lean, B. TRANS., 103.
 Lehfelddt, R. A., ii, 62.
 Lemoine, G., i, 91.
 Ley, H., ii, 67.
 Leys, A., ii, 110.
 Lidoff, A. P., ii, 77, 107.
 Lorenz, H. W. F. See W. Traube.
 Lorenz, R., ii, 61.
 Lucas, A., i, 82.
 Ludwig, E., and T. Panzer, ii, 90.
 Lutoslawski, J., ii, 99.
 Lutschinin, E. See I. L. Kondakoff.

M.

Mac Gregor, J. G., ii, 62.
 Macleod, J. J. R., ii, 92.
 Mc Pherson, W., i, 123.
 Maercker, M., ii, 102.
 Maercker, M., and W. Schniedewind, ii, 105.
 Mahon, R. W., ii, 110.

Mainsbrecq, V., ii, 114.
 Malcolm, J. See T. H. Milroy.
 Maltby, M. E. See F. Kohlrausch.
 Marchlewski, L., i, 100.
 Marcus, E., i, 127.
 Marie, C., ii, 108.
 Maxwell, O. P. See F. J. Pond.
 Mayer, F. See K. Auwers.
 Maynard, G. W., ii, 86.
 Mecke, ii, 120, 123.
 Meyer, R. J., and H. Best, ii, 77, 79.
 Milroy, T. H., and J. Malcolm, ii, 91.
 Möller, E. See E. Ram.
 Mörner, C. T., i, 128.
 Mörner, K. A. H., i, 128.
 Moissan, H., ii, 76.
 Molisch, H., ii, 101.
 Moore, M. J., ii, 106.
 Moreau, L. See J. Laborde.
 Morgan, W. C., i, 103.
 Morley, F. T. See F. A. Gooch.
 Mouren, C., i, 99.
 Müller, E., ii, 73.
 Müller, H. See A. Werner.
 Musset, F., ii, 121.
 Mutschler, L., ii, 106.

N.

Neubauer, H., ii, 108.
 Newcombe, F. C., ii, 99.
 Nissenon, H., ii, 108.
 Nolte, S. See F. W. Alden.
 Norman, G. M. See F. J. Pond.
 Nussberger, G., ii, 90.

O.

Oddo, G., i, 92.
 Oddo, G., and E. Serra, ii, 73, 74.
 Ollendorff, G. See O. Ruff.
 Omeliansky, V., ii, 97.
 Omeliansky, V. See also S. Winogradsky.
 Orton, K. J. P. See F. D. Chattaway.
 Ovi. See E. Deroida.

P.

Panormoff, A. A., i, 126, 127.
 Panzer, T. See E. Ludwig.
 Paris, G., ii, 106.
 Pellet, H., ii, 113.
 Penfield, S. L., and C. H. Warren, ii, 88.
 Pflüger, E., ii, 91, 92.
 Piccinini, A., i, 110.

Pond, F. J., O. P. Maxwell, and G. M. Norman, i, 102.
 Pool, J. F., ii, 107.
 Pottevin, H., i, 77, 80, 81.
 Pouget, I., ii, 84.
 Pfiwoznik, E., ii, 111.
 Puaux. See Rösser.

R.

Rachford, B. K., ii, 91.
 Ram, E., and E. Möller, ii, 104.
 Raymond, R. W., ii, 86.
 Reach, F., i, 126.
 Regelsberger, F. F., ii, 79.
 Reichard, C., ii, 109.
 Reinders, W., ii, 70.
 Richards, T. W., and G. P. Baxter, ii, 78.
 Riechelmann, R., ii, 111.
 Riegler, E., ii, 112.
 Rodewald, H., and A. Kattein, i, 79.
 Rösser, and Puaux, i, 82.
 Rössing, R., ii, 119.
 Roozeboom, H. W. B., ii, 64, 70.
 Rosemann, R., ii, 92.
 Rovaart, H. van de. See K. Auwers.
 Ruff, O., and G. Ollendorff, i, 77.
 Russwurm, ii, 121.
 Ryland, G., ii, 64.

S.

Sabbatani, L., ii, 94.
 Sargent, O. L. See H. J. Wheeler.
 Sarles, E. H., ii, 72.
 Schall, M. See W. Traube.
 Schiff, H., i, 85.
 Schleicher, F. See K. Auwers.
 Schniedewind, W., ii, 105.
 Schniedewind, W. See also M. Maercker.
 Schreiner, O., and E. Kremers, i, 106.
 Schulze, E., ii, 101.
 Schulze, E., and E. Winterstein, i, 110; ii, 101.
 Schwarz, R. See W. Traube.
 Sebaldt, F. See A. Hantzsch.
 Sempolowski, A., ii, 103.
 Seno, K. See K. Katsuyama.
 Serra, E., i, 74.
 Serra, E. See also G. Oddo.
 Sherman, P. L., and C. H. Briggs, ii, 102.
 Shuttleworth, A. E., and B. Tollens, ii, 111.
 Siegfried, M., i, 127.
 Sillevoldt, H. E. T. van, i, 109.
 Smiles, S., TRANS., 160.

Smith, E. F., ii, 80.
 Smith, E. F., E. A. Barnett, and C. Hall, i, 89.
 Smith, E. F., and C. Dugan, i, 76.
 Smith, E. F., and H. Fleck, ii, 81.
 Smith, E. F., and W. L. Hardin, ii, 80.
 Smith, E. F. See also C. F. Clarke, H. M. Fernberger.
 Smith, H. M. See K. Auwers.
 Smoluchowski R. von Smolan, M., ii, 63.
 Sodeau, W. H., TRANS., 137.
 Solonina, W., i, 82.
 Soltsien, P., ii, 116.
 Sosnowski, J., ii, 100.
 Spilker, A. See G. Krämer.
 Stavenhagen, A., ii, 80.
 Steffens, C., i, 74.
 Stoklasa, J., ii, 96, 98, 100.
 Straub, W., ii, 91.
 Strauss, O. See D. Vorländer.
 Strzykowski, C., ii, 123.
 Stutzer, A., and R. Hartleb, ii, 97.
 Süß, P., ii, 93.
 Syniewski, W., i, 78.

T.

Täuber, E., ii, 107.
 Tafel, J., i, 121.
 Tafel, J. See also T. B. Baillie, G. Fenner.
 Tanret, C., and G. Tanret, i, 78.
 Tanret, G. See C. Tanret.
 Taylor, A. E., ii, 115.
 Teclu, N., ii, 71, 72.
 Termier, P., ii, 86.
 Thaeter, Karl, ii, 121.
 Thiel, A. See F. W. Küster.
 Timoféeffsky, D. J., ii, 95.
 Tixier, A., ii, 71.
 Tollens, B. See A. E. Shuttleworth.
 Traube, W., and A. Eyme, i, 118.
 Traube, W., and H. W. F. Lorenz, i, 115.
 Traube, W., and M. Schall, i, 118.
 Traube, W., and R. Schwarz, i, 116.

V.

Valenta, E. See J. M. Eder.
 Vaubel, W., ii, 112.
 Vernon, H. M., ii, 93.
 Virchow, C., ii, 93.
 Vitali, D., ii, 115.

Vorländer, D., i, 99.
 Vorländer, D., and F. Kalkow, i, 99.
 Vorländer, D., and O. Strauss, i, 100.

W.

Wang, E., ii, 122.
 Warren, C. H. See S. L. Penfield.
 Weinland, E., ii, 93.
 Werdenberg, H. See R. Gnehm.
 Werner, A., F. Bräunlich, R. Klein,
 and H. Müller, i, 86.
 Werner, A., and H. E. Conrad, i, 100.
 Wesener, J. A., ii, 92.
 Wheeler, H. J., C. L. Sargent, and
 B. L. Hartwell, ii, 104.
 Whetham, W. C. D., ii, 62.

Wiley, H. W., ii, 122.
 Winogradsky, S., and V. Omelian-
 sky, ii, 96.
 Winterstein, E. See E. Schulze.
 Wintgen, M., ii, 117.
 Wolff, J., ii, 111, 115, 119.
 Wolff, K., ii, 98.
 Wolff, W. See K. Auwera.
 Wrewsky, M., ii, 63.

Z.

Zaharia, A. J., i, 106.
 Zembrzuski, K. von. See H. Lab-
 hardt.
 Zulkowski, K., ii, 76.

ERRATA.

VOL. LXXVII. (TRANS., 1900).

Page Line
 82 bottom for "maleic" read "malic."

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
Victor Meyer Memorial Lecture. By T. E. THORPE, Ph.D., D.Sc., LL.D., F.R.S., President of the Chemical Society	169
XVIII.—Electrolytic Preparation of Induline Dyes. By EMBRIQUE CHARLES SZARVASY, Ph.D.*	207
XIX.—Action of Chloroform and Potassium Hydroxide on <i>o</i> -Aminobenzoic Acid. By WALTER J. ELLIOTT, M.A.	213
XX.—Anhydrous Sulphates of the Form $2M'SO_4, R'SO_4$; especially those of Isometric Crystallisation. By FREDERIC R. MALLET	216
XXI.—C-Derivatives of Hydroxytriazole. By GEORGE YOUNG, Ph.D., and ERNEST WITHAM, B.A., B.Sc.	224
XXII.—Note on Volhard's Method for the Assay of Silver Bullion. By THOMAS KIRKE ROSE, D.Sc.	232
XXIII.—The Chlorine Derivatives of Pyridine. Part V. The Constitution of Oitrazinic Acid. Formation of 2:6-Dichloropyridine and 2:6-Diiodoisonicotinic Acid. By W. J. SELL, M.A., F.I.C., and F. W. DOOTSON, M.A.	233
XXIV.—The Formation of Heterocyclic Compounds. By SIEGFRIED RUHEMANN and H. E. STAPLETON, Scholar of St. John's College, Oxford	239
XXV.—Studies in the Camphane Series. Part I. Nitrocamphane. By MARTIN ONSLOW FORSTER	251
XXVI.—The Refractive and Magnetic Rotatory Powers of some Benzenoid Hydrocarbons. The Refractive Powers of Mixtures. An improved Spectrometer Scale Reader. By W. H. PERKIN, LL.D., Ph.D., F.R.S.	267
XXVII.—The Condensation of Formaldehyde with Ethyl Malonate, and Synthesis of Pentamethylene-1:2:4-tricarboxylic Acid. By J. FRANK BOTTOMLEY and W. H. PERKIN, jun.	294
XXVIII.—Action of Fuming Nitric Acid on α -Dibromocamphor. By ARTHUR LAPWORTH and EDGAR M. CHAPMAN, Salter's Fellow in the Research Laboratory of the Pharmaceutical Society of Great Britain	309

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ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

	PAGE
TSCHUGAEFF (L.). New method of preparing Unsaturated Hydrocarbons	i, 129
KLING (ANDRÉ). Biochemical Oxidation of Propylene Glycol	i, 129
LÉSER (GEORGES). Cyclic Isomeric change of Methylcyclohexadienonol	i, 129
DELÉPINE (MARCEL). Methylene Sulphate or Sulphuric Methylal	i, 130
IMBERT (HENRI) and GUILLAUME BELUGOU. Velocity and Limits of the Esterification of Phosphoric acid	i, 130
WOHL (ALFRED) and C. NEUBERG. Acid Esters of Boric acid	i, 131
BOUVEAULT (LOUIS). α -Dimethylisocrotonic (2-dimethyl-3-butenoic) acid	i, 131
GOLDSCHMIDT (HEINRICH) and LAZAR OSLAN. Ethyl Acetoacetate	i, 132
BAEYER (ADOLF VON) [with OTTO SEUFFERT]. Orientation in the Terpene Series. XXIV	i, 132
BAEYER (ADOLF VON) and VICTOR VILLIGER. Action of Caro's Reagent on Ketones	i, 133
BLANC (G.). Action of Aluminium Chloride on Camphoric Anhydride	i, 133
BREDT (JULIUS) and WILHELM JAGELKI. Camphenilanaldehyde and Camphenilanic acid	i, 134
MAQUENNE (LÉON). Preparation of Azelaic acid	i, 135
ERDMANN (HUGO). Malic acid from <i>Hippophae rhamnoides</i>	i, 135
ROSENHEIM (ARTHUR) and HERRMANN ITZIG. Some complex salts of Tartaric and Malic acids and their Specific Rotatory Power	i, 135
BREDT (JULIUS) and J. B. C. KERSHAW. Action of Nitric acid on Acids of the Fatty series which contain the Isopropyl group	i, 136
LABBÉ (HENRI). Natural Cyclic Isomeric Change of Citronellal	i, 136
LABBÉ (HENRI). Formation of Barium Citryl and Citronellyl Sulphites	i, 137
BIDDLE (HENRY C.). Derivatives of the Isuretine of Formhydroxamic acid and their relation to Fulminic acid	i, 137
NEUBERG (CARL). Purification of Osazones and Estimation of their Rotatory Power	i, 139
RUFF (OTTO) [and in part MEUSSER]. <i>d</i> -Erythrose	i, 139
WOHL (ALFRED). Degradation of <i>l</i> -Arabinose	i, 140
FISCHER (EMIL). Resolution of Racemic compounds into active components	i, 140
FRANCHIMONT (ANTOINE PAUL NICOLAS). Action of Acetic Anhydride on Cellulose in presence of Sulphuric acid	i, 141
ASTRUC (A.). Alkalimetry of the Amines	i, 141
RAGLAND (C. D.). Double Halogen salts of Cadmium with the Methylamines and Tetramethylammonium	i, 141
COOK (C. G.). Double Halogen salts of Tin with Aliphatic Amines and with Tetramethylammonium	i, 142
SPRUYT (G. BELLAAR). Physiological action of Methylnitramine in relation to its Chemical Constitution	i, 142
PALOMAA (H.). Preparation of Ethyldichloroamine	i, 143
TOERNIAC (JOSEPH). Preparation of Ethyldichloroamine	i, 143
MAROKWALD (WILHELM). Stereochemistry of Nitrogen [Propylisobutylamine]	i, 143
ELLINGER (ALEXANDER). Constitution of Lysine	i, 143
MEERBURG (P. A.). Derivatives of Pyrotartaric acid and of the Isomeric Glutaric acid	i, 143
CAZENEUVE (PAUL). Synthesis of Parabanic acid	i, 144

	PAGE
SCHOLL (ROLAND). Constitution and Synthetical Application of Mercury Fulminate. I. Direct Aldoximation of Benzene	i, 144
BAMBERGER (EUGEN) and JENS MÜLLER. Action of Nitric Peroxide on Mercury dimethyl	i, 145
IMBERT (HENRI). Heat of Neutralisation and Acidimetry of Cacodylic acid	i, 145
WISCHIN (RUDOLF). Cyclic Polymethylenes of [Russian] Petroleum	i, 146
GIRAN (H.). New compounds of Phosphoric Oxide with Benzene	i, 146
CALHANE (D. F.) and P. M. WHEELER. Constitution of α -Dibromodinitrobenzene	i, 146
BRUYN (CORNELIS ADRIAAN LOBBY DE). Rate of Substitution of Nitro-groups by an Alkoxy Group	i, 146
RAALTE (A. VAN). Phenyl- and <i>p</i> -Chlorophenyl-nitromethane	i, 147
SOLONINA (BASIL A.). Separation of Primary, Secondary, and Tertiary Amines by Ginsberg's method	i, 147
MARCKWALD (WILHELM). Behaviour of Sulphonamides of Primary Amines towards Alkalis	i, 149
LABBÉ (HENRI). Fixation of Sodium Hydrogen Sulphite by Ethylene Linkings	i, 149
KRAEMER (GUSTAV) and ADOLF SPILKER. Resin Oil	i, 150
FRIEDLÄNDER (PAUL). Conversion of 1:5- and 1:8- Dinitronaphthalenes into Nitronitrosenaphthols	i, 150
PELLEGRIN (MICHEL). Fittig's Reaction	i, 151
HIEN (T.). Synthesis of Picene	i, 151
RICHARDSON (GEORGE H.) and MAXWELL ADAMS. Double Halogen salts of Tin with Organic Bases	i, 151
CHATTAWAY (FREDERICK D.), KENNEDY J. P. ORTON, and W. H. HURTLEY. Anilides	i, 151
CHATTAWAY (FREDERICK D.) and KENNEDY J. P. ORTON. Substituted Nitrogen Bromides, and their relationship to Bromo-substituted Anilides and Anilines	i, 152
VITTENET (HENRI). <i>s</i> -Dinitrodixylylcarbamides and Dinaphthylcarbamides	i, 153
VITTENET (HENRI). Aromatic Carbimides	i, 153
WEDEKIND (EDGAR). Characteristics of Stereoisomeric Ammonium Salts	i, 155
HUGERSHOFF (A.). Acyl derivatives of the Aromatic Thiocarbamides: their Isomerism and Constitution	i, 155
ORNDORFF (WILLIAM R.) and F. A. RICHMOND. Phenylthiocarbimide as a Reagent for the detection of the Alcoholic Hydroxyl group	i, 156
WOHL (ALFRED). Conversion of Nitrobenzene into <i>o</i> -Nitrophenol by means of Caustic Potash	i, 157
MOREL (ALBERT). Reaction of Phenyl Chloroacetate	i, 157
MOREL (ALBERT). Reactions of Phenyl Chloroacetate and Phenyl Glycollate	i, 158
KYM (OTTO). Action of Chlorodinitrobenzene on Potassium Benzoate and on Acetamide	i, 158
BRIDGE (JOHN L.) and WM. CONGER MORGAN. Ethers of Isonitrosoguaiacol in their relation to the Space Isomerism of Nitrogen	i, 158
AUWERS (KARL). Relation between the structure of Meta-phenol [<i>m</i> -Hydroxybenzyl] Haloids and their behaviour towards Alkalis	i, 159
AUWERS (KARL) and O. ANSELMINO. Degradation of Phenols during Bromination	i, 159
AUWERS (KARL). Action of Chloroform and Alkalis on 1:3:4-Xylenol	i, 160
AUWERS (KARL). Oxidation products of Phenols and Bromophenols, and the constitution of the Isomeric Tribromo- ψ -cumenol	i, 161
AUWERS (KARL) and A. EBNER. Oxidation products of Tribromo- ψ -cumenol	i, 161
AUWERS (KARL) and TH. MAAS. Dibromo- <i>m</i> -hydroxy- ψ -cumyl dibromide	i, 162
AUWERS (KARL) and J. BROCHER [and in part W. WOLFF]. Oxidation products of Phenols and Bromophenols	i, 162

	PAGE
BOURGEOIS (EDOUARD). Preparation of Aromatic Thiols	i, 163
HENRICH (FERDINAND). Constitution of Mononitrosoresorcinol	i, 163
DELÉPINE (MARCEL). Action of Methylene Sulphate on Benzyl Alcohol	i, 163
AUWERS (KARL) and S. DAECKE. Action of Bromine on <i>p</i> -Hydroxybenzyl Alcohol	i, 164
AUWERS (KARL) and W. RICHTER. Action of Bromine on <i>m</i> -Hydroxybenzyl Alcohol	i, 165
AUWERS (KARL), F. A. TRAUN, and R. WELDE. Tribromo-derivatives of ψ -Cumenol and Mesitol	i, 165
AUWERS (KARL) and F. A. TRAUN. Dibromo- <i>p</i> -hydroxymesityl Alcohol	i, 167
AUWERS (KARL), F. A. TRAUN, and K. WELDE. Substituted Phenyl Benzyl Ethers	i, 168
RABAUT (CHARLES). Hydrolysis of Benzonitrile	i, 170
PSCHOER (ROBERT) and O. WOLFES. Isomeric change of <i>o</i> -Amino- and <i>o</i> -Nitro-cinnamonitriles	i, 170
HALLER (ALBIN) and ALFRED GUYOT. Tautomerism of <i>o</i> -Benzoylbenzoic acid	i, 170
BOUVEAULT (LOUIS). Synthesis of Cyclopentane derivatives by means of Ethyl Adipate	i, 171
DAM (J. W. VAN). Action of Potassium Hypobromite on Amides of Hydroxybenzoic acids	i, 171
HENRY (LOUIS). Anisonitrile	i, 172
FISCHER (EMIL). Resolution of Racemic Amino-acids into optically active components	i, 172
PECHMANN (HANS VON). Coumarins	i, 173
PECHMANN (HANS VON) and MAX SCHAAL. Coumarins. II. 7-Dimethyl-amino-4-methylcoumarin and Homologues	i, 173
PECHMANN (HANS VON) and OTTO SCHWARZ. Coumarins. III. 7-Amino-4-methylcoumarin	i, 174
PECHMANN (HANS VON) and OTTO SCHWARZ. Coumarins. IV. Action of <i>m</i> -Aminophenol on Ethyl Acetoacetate	i, 174
ANSELM (FRITZ) and F. ZUCKMAYER. Derivatives of Naphthalic acid	i, 175
HERZIG (JOSEF) and FRANZ WENZEL. Methyl Phloroglucinolcarboxylate	i, 176
SLAMA (FRANZ). Preparation of Hydroxystyrogallol	i, 177
BRÄUTIGAM (W.). Solanthalic acid	i, 177
DELÉPINE (MARCEL). Metallic derivatives of Salicylhydramide	i, 177
LABBÉ (HENRI). Preparation of Anisaldehyde	i, 177
BAUR-THURGAV (ALBERT) and AUGUST BISCHLER. Aldehyde-musk	i, 178
PSCHOER (ROBERT) and C. SUMULEANU. <i>o</i> -Nitrovanillin	i, 178
STOBBE ([HANS] and RICHARD FISCHER). Condensation of Cyclic Ketones with Ethyl Succinate	i, 179
WALLACH (OTTO). Methylcyclohexanone	i, 179
COUSIN (H.). Preparation of Tetrachloro- and Tetrabromo-orthoquinones from the corresponding Tetrahaloid Guaiacols and Veratroles	i, 179
KEHRMANN (FRIEDRICH) [with in part O. KRÜGER and M. SCHOEN]. Stereochemistry of Quinoneoximes	i, 180
SLAMA (FRANZ). Halogen derivatives of Anthragallol	i, 181
BOUVEAULT (LOUIS). Constitution of Camphor	i, 182
HALLER (ALBIN) and PAUL TH. MÜLLER. Molecular Refraction and Dispersion, and Specific Rotation of Alkyl-derivatives of Camphor	i, 182
HARRIES (CARL D.) and GEORG ROEDER. Pulegone and Isopulegone	i, 182
BLAISE (EDMOND D.) and G. BLANC. Camphenylone	i, 183
SCHIMMEL & Co. Etheral Oils	i, 184
TANRET (CHARLES) and GEORG TANRET. Rhamninase and Xanthorhamnin	i, 185
TSCHIRCH ([WILHELM OSWALD] ALEXANDER). Rhubarb and its active Constituents	i, 185
ADRIAN (L. ALPHONSE) and AUGUSTE TRILLAT. Colouring matter of Digitalis	i, 185
REEB (MORITZ). Active constituents of the Wallflower	i, 186

	PAGE
CALLSEN (JÜRGEN). Alkaloids of the Seeds of <i>Lupinus angustifolius</i> and of <i>L. perennis</i> , var. <i>pollyphyllus</i>	i, 186
FAUST (EDWIN S.). Alkaloids of the Salamander	i, 186
TROWBRIDGE (PERRY F.). Behaviour of Iodoform and Chloroform with Strychnine	i, 187
TROWBRIDGE (PERRY F.) Action of Methylene Iodide on Strychnine	i, 187
SCHMIDT (ERNST). Action of Iodine on Piperidine, Tetrahydroquinoline, and Tetrahydroisoquinoline	i, 187
KNUEPPEL (CHR. A.). 6-Aminoquinoline and its derivatives	i, 187
ERDMANN (HUGO). 4-Hydroxycarbostyryl from Anthranilic acid	i, 188
KOENIGS (WILHELM). Action of Aldehydes on Quinoline derivatives containing a Methyl or Methylene Group in position 2 or 4	i, 189
KYM (OTTO). Amino-derivatives of α -Phenylbenzothiazole	i, 190
DIEPOLDER (EMIL). Methyl- <i>o</i> -anisidine, Methyl- <i>o</i> -aminophenol and their oxidation products (6-Methylphenoxazine-2:3-quinone)	i, 191
TRILLAT (AUGUSTE). Action of Nitrous acid on the Leuco Base, $C_{18}H_{24}N_4$	i, 192
BOURGEOIS (ÉDOUARD). Constitution of Metallic Salipyrines (Metallic Antipyrine-salicylates)	i, 193
BAMBERGER (EUGEN). History of Diazonium salts	i, 193
BAMBERGER (EUGEN) and ARMAND STIEGELMANN. Action of Aromatic Nitroso-derivatives on <i>as</i> -Alkyl Aromatic Hydrazines	i, 193
WERNER (ALFRED) and EDMOND STIASNY. Nitro-derivatives of Azo-, Azoxy-, and Hydrazo-benzene	i, 194
CAZENEUVE (PAUL) and MOREAU. Preparation of Carbazides: Action of Phenol Carbonates	i, 196
ZEYNEK (RICHARD VON). Formation of Methæmoglobin	i, 196
YVON (PAUL). Amylase	i, 196

PART II.

General and Physical Chemistry.

AUBEL (EDMOND VON). Indices of Refraction of Metals	ii, 125
BILTZ (HEINRICH). Colour changes of illuminated substances	ii, 125
CURIE (P.) and SKŁODOWSKA CURIE. Chemical effects produced by Becquerel Rays	ii, 125
VILLARD (P.). Chemical action of X-Rays	ii, 125
BEQUEREL (HENRI). Phosphorescence Phenomena produced by the radiations from Radium	ii, 126
BEQUEREL (HENRI). Influence of the Magnetic Field on the Rays emitted by Radio-active substances	ii, 126
BEQUEREL (HENRI). Radiation of Radio-active substances	ii, 126
CURIE (P.). Action of the Magnetic Field on Becquerel Rays: Deflected and undeflected Rays	ii, 126
CURIE (SKŁODOWSKA). Penetration of undeflected Becquerel Rays	ii, 126
HITTOFF (JOHANN) WILHELM. Electromotive behaviour of Chromium	ii, 127
ABEGG (RICHARD) and EMIL BOSE. Influence of the addition of a salt with one similar ion on electromotive force and diffusion velocity	ii, 127
DU BOIS (H.) and OTTO LIEBKNECHT. Molecular susceptibility of the salts of the Rare Earths	ii, 127
AUBEL (EDMOND VON). Change of Thermal Conductivity during melting	ii, 128
LEE (N. J. VAN DER). Influence of pressure on the critical temperature of complex mixture	ii, 129
FORCRAND (ROBERT DE). Hydrate of Sodium Peroxide and preparation of Hydrogen Peroxide	ii, 129

	PAGE
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Compound Metallic Radicles : Mercury derivatives	ii, 129
BONNEFOI (J.). Compounds of Lithium Chloride with Ethylamine	ii, 130
BERTHELOT (MARCELLIN P. E.) and MARCEL DELÉPINE. Lactic acid	ii, 130
MÜLLER (JOSEPH AUGUSTE). Heats of fractional neutralisation of Carbonyl- hydroferrocyanic acid compared with those of Hydroferrocyanic acid	ii, 130
LEROY (ÉMILE). Narceine	ii, 131
ODDO (GIUSEPPE). Fractional Distillation under reduced pressure	ii, 131
WILDERMANN (MEYER). Determination of Freezing Points in dilute solutions	ii, 131
ROOZEBOOM (HENDRIK WILLEM BAKHUIS). Freezing Points of Mixed Crystals of two compounds	ii, 132
ROOZEBOOM (HENDRIK WILLEM BAKHUIS). Transition Points in Mixed Crystals	ii, 132
EIJK (C. VAN). Formation and Transition of Mixed Crystals of Potassium and Thallium Nitrates	ii, 133
AUWERS (KARL) [and MAX DOHRN]. Cryoscopic researches on the con- stitution of Acid Amides	ii, 134
WAALS (JOHANNES DIDERIK VAN DER). Accurate determination of the Molecular Weight of Gases from their Density	ii, 134
KANONNIKOFF (INNOCENTIUS I.). True density of chemical compounds and its relation of composition and constitution	ii, 134
RINGANUM (MAX). Equation of condition	ii, 135
SCHREINEMAKERS (FRANS ANTOON HUBERT). Equilibrium in the system, Water—Phenol—Aniline	ii, 135
BODENSTEIN (MAX). False Equilibrium	ii, 136
BRUYN (CORNELIS ADRIAAN LOBBY DE). Condition of substances insoluble in Water formed in Gelatin	ii, 136
DEBUS (HEINRICH). Genesis of Dalton's Atomic Theory	ii, 136
BEHRENS (THEODOR HEINRICH). Some anomalies in Mendeleëff's System	ii, 136
SANDER (W.). Relation of physical properties of elements to their Atomic Weights	ii, 137

Inorganic Chemistry.

HETEREN (W. J. VAN). Nitrosyl Chloride and its compounds	ii, 137
MICHAELIS (AUGUST) and M. PITSCH. The Lower Oxides of Phosphorus	ii, 137
VANINO (LUDWIG). A general property of Phosphorus acid	ii, 138
MELIKOFF (PETR G.) and S. LORDEKIPANIDZE. Fluorohyperborates	ii, 138, 139
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Explosion of Potassium Chlorate	ii, 139
WEINLAND (RUDOLPH F.) and O. KÖPPEN. Acid Iodates containing Fluorine, and Cesium Fluoroperiodate	ii, 139
JOUNIAUX. Reversible reaction between Hydrogen Chloride and Silver	ii, 139
COLSON (ALBERT). Reciprocal displacement of Metals	ii, 140
PRUNIER (L. LÉON A.) and ADOLPHE JOUVE. Preparation of Monocalcium Phosphate	ii, 140
LE CHATELIER (HENRI). Change of Volume during the Hardening of Hydraulic Cements	ii, 140
MOISSAN (HENRI). Action of Hydrogen Fluoride and Fluorine on Glass	ii, 140
MOURELO (JOSÉ RODRIGUEZ). Activity of Manganese in promoting the Phosphorescence of Strontium Sulphide	ii, 141
KASTLE (J. H.) and MARY E. CLARK. Effect of various Solvents on the Allotropic Change of Mercuric Iodide	ii, 141
GRNEZ (DÉSIRÉ). Transformation Temperature of the Quadratic and Orthorhombic Forms of Mercuric Iodide	ii, 141
FRANÇOIS (MAURICE). Dissociation by Water of Ammonium and Potassium Mercuriodides	ii, 142

	PAGE
MUTHMANN (WILHELM) and L. STÜTZEL. Preparation of Sulphur, Chlorine, and Bromine compounds of the Cerite Metals	ii, 142
MEYER (STEFAN). Specific Gravity of Yttrium, Zirconium, and Erbium	ii, 143
ARONS (LEO). Direct Combination of Aluminium and Nitrogen in the Electric Arc	ii, 143
WEINLAND (RUDOLPH F.) and O. KÖPPEN. Double salts of Ferric and Aluminium Fluorides with Fluorides of Bivalent Metals	ii, 143
THOMAS (VICTOR). Action of Nitric Oxide on Chromyl Dichloride	ii, 144
GUICHARD (MARCEL). Molybdenum Disulphide	ii, 144
VIGOUROUX (ÉMILE). Molybdenum Silicide	ii, 144
KEHRMANN (FRIEDRICH) and E. RÜTTIMANN. Complex Inorganic acids. VIII. Arsenoduodecitungstic and Arsenoluteotungstic acids	ii, 145
DELAUROIX (A. E.). Antimonic acid and Antimonates	ii, 145
LEIDIE (ÉMILE). Sesquichlorides of Rhodium and Iridium	ii, 146

Mineralogical Chemistry.

CHARITSCHKOFF (K. W.). Composition of Naphtha from Grosny	ii, 147
THIELE (F. C.). Texas Petroleum	ii, 147
KOVÁČ (FRANTIŠEK). Analysis of Moravian Minerals	ii, 147, 148, 149
ZAMBONINI (FERRUCCIO). Magnetite from near Rome	ii, 147
OEHMICHEN (H.). Auriferous Cobalt Ores in the Transvaal	ii, 147
ANDERSSON (J. G.) and N. SAHLBOM. Fluorine in Swedish Phosphorites	ii, 148
OETLING (C. F. W. A.). Solidification of Fused Silicates under High and Normal Pressures	ii, 149
ZAMBONINI (FERRUCCIO). Olivine from Latium	ii, 149
BUTUREANU (VASILE C.). Mineral Analyses	ii, 149
ZAMBONINI (FERRUCCIO). Two new Hydrosilicates	ii, 149
MOORE (CHARLES C.). Analyses of Sandstone Concretions	ii, 150
READE (T. MELLARD) and PHILIP HOLLAND. Phyllades and Slates	ii, 150
VOGT (J. H. L.). Vanadium in Rocks	ii, 150
MILCH (LUDWIG). Rocks from Sumatra	ii, 150
FOOTE (WARREN M.). Meteoric Iron from Iredell Texas	ii, 150
HOLLAND (PHILIP) and EDMUND DICKSON. Analyses of Glacial Deposits and Waters	ii, 151

Physiological Chemistry.

LARDE (E.). Influence of some Alcohols of Simple or Complex Function on the Digestion of Proteids by Pepsin or Trypsin	ii, 151
ALBU (A.). Protein Metabolism	ii, 151
MENDEL (LAFAYETTE B.) and ERNEST W. BROWN. Nitrogenous Metabolism in the Cat	ii, 151
JELLINEK (S.) and FR. SCHIFFER. Comparative Determinations of the Specific Gravity, Dry Residue, and amount of Iron in Blood	ii, 152
PANZER (THEODOR). Cerebro-spinal Fluid	ii, 152
VERTUN. Hydrocele Fluid	ii, 152
MENDEL (LAFAYETTE B.). Iodine in the Thymus and Thyroid	ii, 152
GAUTIER ([ÉMILE JUSTIN] ARMAND). Normal existence of Arsenic in Animals and its localization in certain Organs	ii, 152
NIKOLAIDES (R.). Fat in Glands during Inanition	ii, 153
CASPARI (WILHELM). The Source of Milk Fat	ii, 153
WALDVOGEL. Formation of Acetone in the Body	ii, 153
WIENER (HUGO). The Decomposition and Formation of Uric acid in the Body	ii, 153

	PAGE
MUNK (IMMANUEL) and MAX LEWANDOWSKY. Fate of Proteids after their introduction into the Circulation	ii, 154
ROST (E.). Fate of 8-Hydroxyquinoline: Excretion of Ethereal Hydrogen Sulphates: Composition of Quinosol	ii, 154
MOORE (BENJAMIN) and J. T. BERGIN. Chemical Reaction of the Intestinal contents	ii, 154
CLAUDE (H.) and W. BALTHAZARD. Cryoscopy of Urine in Diagnosis and Prognosis	ii, 154
CLOËTTA (MAX). Origin of the Proteids in Albuminuria	ii, 155
ROSENQVIST (EMIL). Sugar Formation in severe cases of Diabetes	ii, 155
MAGNUS-LEVY (ADOLF). Hydroxybutyric acid and its relationship to Diabetic Coma	ii, 155
MAYER (PAUL). Excretion and Detection of Glycuronic acid in the Urine	ii, 155
MARTIN (CHARLES F.). Excretion of Alloxuric substances in Nephritis	ii, 155
MEYER (HANS). Theory of Narcosis	ii, 156
BAUM (FRITZ). Theory of Narcosis	ii, 156
MALLET (JOHN WILLIAM). Physiological action of Creatine and Creatinine, and their Value in Nutrition	ii, 156
BESREDKA. Role of Leucocytes in Poisoning by Compounds of Arsenic	ii, 156
DANYSZ (JEAN). Action on the Tetanus Toxin on Nervous Substances	ii, 156
KOBBERT (RUDOLF). Fungus Poisons which Decompose Blood	ii, 156

Chemistry of Vegetable Physiology and Agriculture.

WRÓBLEWSKI (AUGUSTIN). Buchner's Yeast Extract	ii, 157
LAER (VAN). [A Beer Disease]	ii, 158
JENNINGS (HERBERT S.). Reactions to Stimuli in Unicellular Organisms	ii, 158
GARREY (WALTER E.). Effect of Ions on Flagellated Infusoria	ii, 158
EMMERICH (RUDOLF) and OSKAR LOWE. Bacteriological Enzymes as a cause of Immunity, and their Healing Action in Infective Diseases	ii, 159
ANDRÉ (GUSTAVE). Changes in the Mineral Constituents of Seed during Germination	ii, 159
GRIFFON (ED.). Chlorophyllous Assimilation induced by Sunlight filtered through Leaves	ii, 159
BOGDANOFF (SERGEI M.). Amount of Sulphur in Plants	ii, 160
BRUYNING (F. F.) and J. VAN HAARST. Hydrocyanic acid in <i>Vicia</i> Seeds	ii, 160
BERTRAND (GABRIEL). Presence of Mannocellulose in Ligneous Tissues	ii, 160
POLLACCI (GINO). Presence of Formaldehyde in Plants	ii, 160
MAQUENNE (LÉON). The "Honey" of <i>Euonymus Japonica</i>	ii, 161
D'ANCONA (GIUSEPPE). <i>Lotus corniculatus</i>	ii, 161
DEMOUSSY (EM.). Absorption of Soluble salts by Plants	ii, 161
PASSERINI (NAPOLEONE). Composition of the Branches of Pear Trees removed by regular thinning	ii, 162
NESSLER (JULIUS). Which Meadows should be Manured with Potash as well as with Superphosphate and Basic Slag?	ii, 162
IMMENDORFF (HEINRICH). Composition of <i>Molinia caerulea</i> and <i>Carex Goodenoughii</i>	ii, 162
HANAMANN (JOSEPH) and LEOPOLD KOURINSKY. Hops and Hop Soils	ii, 163
STOKLASA (JULIUS). Influence of Potash on the Development of Sugar Beet	ii, 163
WILFARTH (H.). Assimilation by Sugar Beet and Estimation of available Nutritive matter in Arable Soil	ii, 163
WILMS (JOHANN). Influence of the amount of Water and of Nutritive Substances in Soil on the Activity and Development of Potatoes	ii, 164
PAGNOUL (AIME). How much Phosphoric acid should good Arable Soils contain?	ii, 164
KRÜGER (W.) and W. SCHNEIDEWIND. Alinit	ii, 164
IMMENDORFF (HEINRICH). Composition of Green Manure grown in Peaty and Sandy Soils	ii, 164
WEBER (H. A.). Testing Soil for application of Commercial Fertilisers	ii, 165

Analytical Chemistry.

	PAGE
WOLOWSKI (C.). Estimation of Chlorine in Bleaching Powder . . .	ii, 165
VANINO (LUDWIG) and O. HAUSER. Separation of Chlorine and Iodine . .	ii, 165
VINCENT (E.). Titration of Potassium Iodide . . .	ii, 166
ZETSCHKE (F.). Estimation-of Dissolved Oxygen in Water . . .	ii, 166
WYBOUBOFF (GREGOIRE N.). Estimation of Sulphuric acid in the presence of Iron . . .	ii, 166
VEITCH (F. P.). Estimation of Nitrogen in Fertilisers containing Nitrates .	ii, 166
VEITCH (F. P.). Direct Estimation of available Phosphoric acid . . .	ii, 166
PAGNOUL, AIMÉ. Estimation of the available Phosphoric acid in Soils . .	ii, 167
LASNE (HENRI). Detection of Fraudulent Addition to Bone-superphosphate	ii, 167
DAFERT (FRANZ W.). Valuation of Basic Slags . . .	ii, 167
GAUTIER ([EMILE JUSTIN], ARMAND). Detection and Estimation of very small quantities of Arsenic in the Organs . . .	ii, 168
FORD (ALLEN P.) and IVAN M. BREGOWSKY. Estimation of Graphitic Carbon in Cast Iron and Pig Iron . . .	ii, 168
NOYES (WILLIAM A.), WILLIAM F. HILLEBRAND, and CHARLES B. DUDLEY. Report of the [American] Committee on Coal Analysis . . .	ii, 168
MEADE (RICHARD K.) and JAMES C. ATTIX. Estimation of Volatile Com- bustible Matter in Coke and Anthracite Coal . . .	ii, 168
THOMAS (GEORGE E.). Apparatus for the analysis of Illuminating and Fuel Gases . . .	ii, 169
IPSEN (KARL). Chemical Detection of Carbonic Oxide in Blood . . .	ii, 169
WACHHOLZ (LEO). Chemical Detection of Carbonic Oxide in Blood . . .	ii, 169
HELD (ALFRED). Apparatus for the estimation of Carbon Dioxide in Mineral Waters . . .	ii, 169
CHEVALET (F.). Estimation of Carbon Dioxide in Ammoniacal Gas Liquor .	ii, 170
WOY (RUDOLF). Stutzer and Hartleb's process for the estimation of com- bined Carbon Dioxide (Calcium Carbonate) in Soils . . .	ii, 170
GIRAUD (JULIEN). Estimation of Silver on Plated Copper Utensils . . .	ii, 170
LEHMANN (KARL BERNHARD). Estimation of small quantities of Zinc in Organic Substances, especially in Apple Chips . . .	ii, 170
BROWNING (PHILIP E.) [with WM. D. CUTLER, G. A. HANDFORD, LEO A. LYNCH, and F. J. MALL]. Titrimetric estimation of Cerium . . .	ii, 170
CRONQUIST (WERNER). Preliminary Tests for Clays . . .	ii, 171
BORNTRÄGER (HUGO). Rapid Solution of Ignited Ferric Oxide . . .	ii, 171
FRIEDHEIM (CARL) and ERNST BRÜHL. Use of Hydrogen Peroxide in Quantitative Analysis . . .	ii, 171
BROWNING (PHILIP E.) and GEORGE P. HUTCHINS. Estimation of Thallium as Chromate . . .	ii, 172
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Ultimate analysis of Organic compounds . . .	ii, 172
VALEUR (AMAND). Estimation of Halogens in Organic compounds . . .	ii, 172
PFEIFFER (OTTO). Estimation of Benzene Vapour in Illuminating Gas . .	ii, 173
SOLDAINI (ARTURO) and E. BERTÉ. Analysis of Ethereal Oils, especially the <i>Citrus</i> Oils . . .	ii, 173
WALTHER (J.). Valuation of Lemon-oil . . .	ii, 173
MITCHELL (A. S.). Lemon Flavouring Extract and its Substitutes . . .	ii, 174
VINCENT (E.). Estimation of Mercuric Cyanide . . .	ii, 174
VENTUROLI (GIUSEPPE). Detection of Nitroprussides in Cases of Poisoning .	ii, 174
CUNIASSE (L.). Action of strong Aqueous Soda on Methyl Acetate in the Presence of Methyl Alcohol and Acetone . . .	ii, 175
BECKMANN (ERNST) [and H. BRÜGGEMANN.] Estimation of Fusel Oil in Alcoholic Liquids . . .	ii, 175
SCHIMMEL & Co. Estimation of Geraniol in Oil of Citronella . . .	ii, 175
KEBLER (LYMAN F.). Wood Tar Creosote . . .	ii, 176
PATEIN (GUSTAVE) and E. DUBAU. Estimation of Sugar in Diabetic Urine .	ii, 176
POSSETTO (GIOVANNI). Rapid Estimation of Sugar in Fatty Substances . .	ii, 176

	PAGE
CRISPO (D.). Rapid Process for the Estimation of Starch: Estimation of Starch in Yeast	ii, 177
JANDRIER (EDMOND). Chemical Detection of Vegetable Fibres	ii, 177
SCHNEIDER. Separation of Lactic, Butyric, and Valeric acids	ii, 177
SPAETH (EDUARD). Volatile acids in Beer: Detection of Neutralising Agents in Beer	ii, 177
MAYER (PAUL). Detection of Glycuronic acid in Urine	ii, 178
MOLLHINEY (PARKER C.). Determination of the Bromine Absorption of Oils	ii, 178
BÖMER (A.) and K. WINTER. Detection of Sesamé Oil	ii, 178
TIMPE (H.). Milk Analysis. New process for simultaneous estimation of Residue, Fat, and Ash	ii, 179
JEAN (FERDINAND). Determination of the Melting Point of Fats	ii, 179
BLASER (HERMANN). Detection of Acetaldehyde in Ether	ii, 179
LEWIN (LOUIS). [Detection of] Acetaldehyde in certain other Aldehydes	ii, 179
OFFENHEIMER (CARL). Detection of Acetone in Urine and other Animal Secretions	ii, 180
CLAUSER (ROBERT). New method of Indigo Assay	ii, 180
MUCKE. A new Alkaloidal Reagent: Detection of Opium	ii, 180

INDEX OF AUTHORS' NAMES.

A.

- Abegg, R., and E. Bose, ii, 127.
 Adams, M. See G. H. Richardson.
 Adrian, L. A., and A. Trillat, i, 185.
 Albu, A., ii, 151.
 Andersson, J. G., and H. Sahlbom,
 ii, 148.
 André, G., ii, 159.
 Anselm, F., and F. Zuckmayer,
 i, 175.
 Anselmino, O. See K. Auwers.
 Arons, L., ii, 143.
 Astruc, A., i, 141.
 Attix, J. C. See R. K. Meade.
 Aubel, E. von, ii, 125, 128.
 Auwers, K., i, 159, 160, 161.
 Auwers, K., and O. Anselmino,
 i, 159.
 Auwers, K., J. Broicher, and W.
 Wolff, i, 162.
 Auwers, K., and S. Daecke, i, 164.
 Auwers, K., and M. Dohrn, ii, 184.
 Auwers, K., and A. Ebner, i, 161.
 Auwers, K., and T. Maas, i, 162.
 Auwers, K., and W. Richter, i, 165.
 Auwers, K., and F. A. Traun, i, 167.
 Auwers, K., F. A. Traun, and R.
 Welde, i, 165, 168.

B.

- Baeyer, A. von, and O. Seuffert,
 i, 132.
 Baeyer, A. von, and V. Villiger,
 i, 133.
 Balthazard, W. See H. Claude.
 Bamberger, E., i, 193.
 Bamberger, E., and J. Müller, i, 145.
 Bamberger, E., and A. Stiegelmann,
 i, 193.
 Baum, F., ii, 156.
 Baur-Thurgau, A., and A. Bischler,
 i, 178.

- Beckmann, E., and H. Brüggemann,
 ii, 175.
 Becquerel, H., ii, 126.
 Behrens, T. H., ii, 136.
 Belugou, G. See H. Imbert.
 Bergin, J. T. See B. Moore.
 Berté, E. See A. Soldaini.
 Berthelot, M. P. E., ii, 139, 172.
 Berthelot, M., and M. Delépine,
 ii, 130.
 Bertrand, G., ii, 160.
 Besredka, ii, 156.
 Biddle, H. C., i, 137.
 Biltz, H., ii, 125.
 Bischler, A. See A. Baur-Thurgau.
 Blaise, E. E., and G. Blanc, i, 183.
 Blanc, G., i, 134.
 Blanc, G. See E. E. Blaise.
 Blaser, H., ii, 179.
 Bodenstein, M., ii, 136.
 Bömer, A., and K. Winter, ii, 178.
 Bogdanoff, S. M., ii, 160.
 Bonnefoi, J., ii, 130.
 Bornträger, H., ii, 171.
 Bose, E. See R. Abegg.
 Bottomley, J. F., and W. J. Perkin,
 jun., TRANS., 294.
 Bourgeois, E., i, 163, 193.
 Bouveault, L., i, 181, 171, 182.
 Bräutigam, W., i, 177.
 Bredt, J., and W. Jagelki, i, 134.
 Bredt, J., and J. B. C. Kershaw,
 i, 136.
 Bregowsky, I. M. See A. P. Ford.
 Bridge, J. L., and W. C. Morgan,
 i, 153.
 Broicher, J. See K. Auwers.
 Brown, E. W. See L. B. Mendel.
 Browning, P. E., W. D. Cutler,
 G. A. Hanford, L. A. Lynch, and
 F. J. Mall, ii, 170.
 Browning, P. E., and G. P.
 Hutchins, ii, 172.
 Brüggemann, H. See E. Beckmann.
 Brühl, E. See C. Freidheim.
 Bruyn, C. A. L. de, i, 146; ii, 136.

Bruyning, F. F., and J. van Haarst,
ii, 160.
Butureanu, P. C., ii, 149.

C.

Calhane, D. F., and P. M. Wheeler,
i, 146.
Callsen, J., i, 186.
Caspari, W., ii, 163.
Cazeneuve, P., i, 144.
Cazeneuve, P., and Moreau, i, 196.
Chapman, E. M. See A. Lapworth.
Charitschkoff, K. W., ii, 147.
Chattaway, F. D., and K. J. P. Orton,
i, 152.
Chattaway, F. D., K. J. P. Orton,
and W. H. Hurlley, i, 151.
Chevalet, F., ii, 170.
Clark, M. E. See J. H. Kastle.
Claude, H., and W. Balthazard,
ii, 154.
Clauser, R., ii, 180.
Cloëtta, M., ii, 155.
Colson, A., ii, 140.
Cook, C. G., i, 142.
Cousin, H., i, 179.
Crispo, D., ii, 176.
Cronquist, W., ii, 171.
Cuniasse, L., ii, 175.
Curie, P., ii, 126.
Curie, P., and S. Curie, ii, 125.
Curie, S., ii, 126.
Cutler, W. D. See P. E. Browning.

D.

Daecke, S. See K. Auwers.
Dafert, F. W., ii, 167.
Dam, J. W. van, i, 171.
D'Ancona, G., ii, 161.
Danyasz, J., ii, 156.
Debus, H., ii, 136.
Delacroix, A. E., ii, 145.
Delépine, M., ii, 130, 163, 177.
Delépine, M. See also M. Berthelot.
Demoussy, E., ii, 161.
Dickson, E. See P. Holland.
Diepolder, E., i, 191.
Dohrn, M. See K. Auwers.
Dootson, F. W. See W. J. Sell.
Du Bois, H., and O. Liebknecht,
ii, 127.
Dudley, C. B. See W. A. Noyes.
Dufau, E. See G. Patein.

E.

Ebner, A. See K. Auwers.
Eijk, C. van, ii, 133.
Ellinger, A., i, 143.
Elliott, W. J., TRANS., 213.
Emmerich, R., and O. Loew, ii, 159.
Erdmann, H., i, 135, 188.

F.

Faust, E. S., i, 186.
Fischer, E., i, 140, 172.
Fischer, R. See H. Stobbe.
Foote, W. M., ii, 150.
Forcrand, R. de, ii, 129.
Ford, A. P., and I. M. Bregowsky,
ii, 168.
Forster, M. O., TRANS., 251.
Franchimont, A. P. N., i, 141.
François, M., ii, 142.
Freidheim, C. and E. Brühl, ii, 171.
Friedländer, P., i, 150.

G.

Garrey, W. E., ii, 158.
Gautier, A., ii, 152, 168.
Gernex, D., ii, 141.
Giran, H., i, 146.
Girard, J., ii, 170.
Goldschmidt, H., and L. Oslan,
i, 132.
Griffon, E., ii, 159.
Guichard, M., ii, 144.
Guyot, A. See A. Haller.

H.

Haarst, J. van. See F. F. Bruyning.
Haller, A., and A. Guyot, i, 170.
Haller, A., and P. T. Muller, i, 182.
Hanamann, J., and L. Kourinsky,
ii, 163.
Hanford, G. A. See P. E. Browning.
Harries, C. D., and G. Roeder, i, 182.
Hauser, O. See L. Vanino.
Held, A., ii, 169.
Henrich, F., i, 163.
Henry, L., i, 172.
Herzig, J., and F. Wenzel, i, 176.
Heteren, W. J. van, ii, 137.
Hillebrand, W. F. See W. A. Noyes.
Hirn, T., i, 151.
Hittorf, W., ii, 127.

Holland, P., and E. Dickson,
ii, 151.
Holland, P. See T. M. Reade.
Hugershoff, A., i, 155.
Hurtley, W. H. See F. D. Chatt-
away.
Hutchins, G. P. See P. E. Browning.

I.

Imbert, H., i, 145.
Imbert, H., and G. Belugou, i, 130.
Immendorff, H., ii, 162, 164.
Ipsen, K., ii, 169.
Itzig, H. See A. Rosenheim.

J.

Jagelki, W. See J. Bredt.
Jandrier, E., ii, 177.
Jean, F., ii, 179.
Jellinek, S., and F. Schiffer, ii, 152.
Jennings, H. S., ii, 158.
Jouniaux, ii, 139.
Jouve, A. See L. L. A. Prunier.

K.

Kanonnikoff, I. I., ii, 134.
Kastle, J. H., and M. E. Clark,
ii, 141.
Kebler, L. F., ii, 176.
Kehrmann, F., O. Krüger, and M.
Schoen, i, 180.
Kehrmann, F., and E. Rüttimann,
ii, 145.
Kershaw, J. B. C. See J. Bredt.
Kling, A., i, 129.
Knueppel, C. A., i, 187.
Kobert, R., ii, 156.
Koenigs, W., i, 189.
Köppen, O. See R. F. Weinland.
Kourinsky, L. See J. Hanamann.
Kovář, F., ii, 147, 148, 149.
Kraemer, G., and A. Spilker, i, 150.
Krüger, O. See F. Kehrmann.
Krüger, W., and W. Schneidewind,
ii, 164.
Kym, O., i, 158, 190.

L.

Labbé, H., i, 136, 137, 149, 177.
Laborde, E., ii, 151.
Laer, Van, ii, 158.
Lapworth, A., and E. M. Chapman.
TRANS., 309.

Lasne, H., ii, 167.
Le Chatelier, H., ii, 140.
Lee, H. J. van der, ii, 129.
Lehmann, K. B., ii, 170.
Leidié, É., ii, 146.
Leroy, É., ii, 181.
Léser, G., i, 129.
Lewandowsky, M. See I. Munk.
Lewin, L., ii, 179.
Liebknecht, O. See H. Du Bois.
Loew, O. See R. Emmerich.
Lordkipanidze, S. See P. G. Meli-
koff.
Lynch, L. A. See P. E. Browning.

M.

Maas, T. See K. Auwers.
McIlhiney, P. C., ii, 178.
Magnus-Levy, A., ii, 155.
Mall, F. J. See P. E. Browning.
Mallet, F. R. TRANS., 216.
Mallet, J. W., ii, 156.
Maquenne, L., i, 135; ii, 161.
Marckwald, W., i, 143, 149.
Martin, C. F., ii, 155.
Mayer, P., ii, 155, 178.
Meade, R. K., and J. C. Attix,
ii, 168.
Mecke, ii, 180.
Meerburg, P. A., i, 143.
Melikoff, P. G., and S. Lordkipanidze,
ii, 138, 139.
Mendel, L. R., ii, 152.
Mendel, L. B., and E. W. Brown,
ii, 151.
Meusser. See O. Ruff.
Meyer, H., ii, 156.
Meyer, S., ii, 143.
Michaelis, A., and M. Pitsch, ii, 137.
Milch, L., ii, 150.
Mitchell, A. S., ii, 174.
Moissan, H., ii, 140.
Moore, B., and J. T. Bergin, ii, 154.
Moore, C. C., ii, 150.
Moreau. See P. Cazeneuve.
Morel, A., i, 157, 158.
Morgan, W. C. See J. L. Bridge.
Mourelo, J. R., ii, 141.
Müller, J. See E. Bamberger.
Muller, J. A., ii, 130.
Muller, P. T. See A. Haller.
Munk, I., and M. Lewandowsky.
Muthmann, W., and L. Stützel,
ii, 142.

N.

Nessler, J., ii, 162.
Neuberg, C., i, 139.

Neuberg, C. See A. Wohl.
 Nikolaides, R., ii, 153.
 Noyes, W. A., W. F. Hillebrand and
 C. B. Dudley, ii, 168.

O.

Oddo, G., ii, 131.
 Oehmichen, H., ii, 147.
 Oetling, C. F. W. A., ii, 149.
 Oppenheimer, C., ii, 180.
 Orndorff, W. R., and F. A. Richmond, i, 156.
 Orton, J. K. P. See F. D. Chatto-
 way.
 Oslan, L. See H. Goldschmidt.

P.

Pagnoul, A., ii, 164, 167.
 Palomaa, H., i, 143.
 Panzer, T., ii, 152.
 Passerini, N., ii, 162.
 Patein, G., and E. Dufau, ii, 176.
 Pechmann, H. von., i, 173.
 Pechmann, H. von, and M. Schaal,
 i, 173.
 Pechmann, H. von, and O. Schwarz,
 i, 174.
 Pellegrin, M., i, 151.
 Perkin, W. H., son., TRANS., 267.
 Perkin, W. H., jun. See J. F.
 Bottomley.
 Pfeiffer, O., ii, 173.
 Pitsch, M. See A. Michaelis.
 Pollacci, G., ii, 160.
 Possetto, G., ii, 176.
 Prunier, L. L. A., and A. Jouve,
 ii, 140.
 Paschorr, R., and C. Sumuleanu,
 i, 178.
 Paschorr, R., and O. Wolfes, i, 170.

R.

Raalte, A. van, i, 147.
 Rabaut, C., i, 170.
 Ragland, C. D., i, 141.
 Reade, T. M., and P. Holland, ii, 150.
 Reeb, M., i, 186.
 Reinganum, M., ii, 135.
 Richardson, G. H., and M. Adams,
 i, 151.
 Richmond, F. A. See W. R. Orndorff.
 Richter, W. See K. Auwers.
 Roeder, G. See C. D. Harries.
 Roozeboom, H. W. B., ii, 182.

Rose, T. K., TRANS., 232.
 Rosenheim, A., and H. Itzig, i, 135.
 Rosenqvist, E., ii, 155.
 Rost, E., ii, 154.
 Rüttimann, E. See F. Kehrman.
 Ruff, O., and Meusser, i, 139.
 Ruhemann, S., and H. E. Stapleton,
 TRANS., 239.

S.

Sahlbom, N. See J. G. Anderson.
 Sander, W., ii, 137.
 Schaal, M. See H. von Pechmann.
 Schiffer, F. See S. Jellinek.
 Schimmel and Co., i, 184; ii, 175.
 Schmidt, E., i, 187.
 Schneider, ii, 177.
 Schneidewind, W. See W. Krüger.
 Schoen, M. See F. Kehrman.
 Scholl, R., i, 144.
 Schreinemakers, F. A. H., ii, 135.
 Sell, W. J., and F. W. Dootson,
 TRANS., 233.
 Seuffert, O. See A. von Baeyer.
 Slama, F., i, 177, 181.
 Soldaini, A., and E. Borté, ii, 173.
 Solonina, B. A., i, 147.
 Spaeth, E., ii, 177.
 Spilker, A. See G. Kraemer.
 Spruyt, G. B., i, 142.
 Stapleton, H. E. See S. Ruhemann.
 Stiasny, E. See A. Werner.
 Stieglmann, A. See E. Bamberger.
 Stobbe, H., and B. Fischer, i, 179.
 Stoklasa, J., ii, 163.
 Stützel, L. See W. Muthmann.
 Sumuleanu, C. See R. Paschorr.
 Szarvasy, E. C. TRANS., 207.

T.

Tanret, C., and G. Tanret, i, 185.
 Tcherniac, J., i, 143.
 Thiele, F. C., ii, 147.
 Thomas, G. E., ii, 169.
 Thomas, V., ii, 144.
 Thorpe, T. E. TRANS., 169.
 Timpe, H., ii, 179.
 Traun, F. A. See K. Auwers.
 Trillat, A., i, 192.
 Trillat, A. See also L. A. Adrian.
 Trowbridge, P. F., i, 187.
 Tschirch, A., i, 185.
 Tschugaeff, L., i, 129.

V.

Valeur, A., ii, 172.
 Vanino, L., ii, 138.
 Vanino, L., and O. Hauser, ii, 165.

Veitch, F. P., ii, 166.
 Venturoli, G., ii, 174.
 Vertun, ii, 152.
 Vigoureux, E., ii, 144.
 Villard, P., ii, 125.
 Villiger, V. See A. von Baeyer.
 Vincent, E., ii, 166, 174.
 Vittenet, H., i, 153.
 Vogt, J. H. L., ii, 150.

W.

Waals, J. D. van der, ii, 134.
 Wachholz, L., ii, 169.
 Waldvogel, ii, 153.
 Wallach, O., i, 179.
 Walther, J., ii, 173.
 Weber, H. A., ii, 165.
 Wedekind, E., i, 155.
 Weinland, R. F., and O. Köppen,
 ii, 139, 143.
 Welde, R. See K. Auwers.
 Wenzel, F. See J. Herzig.
 Werner, A., and E. Stiasny, i, 194.
 Wheeler, P. M. See D. F. Calhane.
 Wiener, H., ii, 153.
 Wildermann, M., ii, 131.

Wilfarth, H., ii, 163.
 Wilms, J., ii, 164.
 Winter, K. See A. Bömer.
 Wischin, R., i, 146.
 Witham, E. See G. Young.
 Wohl, A., i, 140, 157.
 Wohl, A., and C. Neuberg, i, 131.
 Wolfes, O. See R. Pschorr.
 Wolff, W. See K. Auwers.
 Wolowski, C., ii, 165.
 Woy, R., ii, 170.
 Wróblewski, A., ii, 157.
 Wyrouboff, G. N., ii, 166.

Y.

Young, G., and E. Witham. TRANS.,
 224.
 Yvon, P., i, 196.

Z.

Zambonini, F., ii, 147, 149.
 Zetsche, F., ii, 166.
 Zeynek, R. von, i, 196.
 Zuckmayer, F. See F. Anselm.

ERRATA.

VOL. LXXVII. (TRANS., 1900).

Page Line

139 8* for "mixture of iodate (the iodine) and iodide of potassium to be titrated"
 read "mixture of iodate and iodide of potassium (the iodine to be
 titrated)."

VOL. LXXVIII (ABSTR., 1900).

PART I.

24 15 for "8-nitro-1-nitroso-1-naphthol" read "5-nitro-4-nitroso-1-naphthol."
 ,, 19 ,, "1:3:5:4 or 1:3:8:4" read "2:4:8:1 or 2:4:5:1."
 ,, 15* ,, "1:3:5:4" read "2:4:8:1."

PART II.

139 6 ,, "+3HO" read "+3H₂O."

* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
XXVIII.—Action of Fuming Nitric Acid on α -Dibromocamphor. By ARTHUR LAPWORTH and EDGAR M. CHAPMAN, Salter's Fellow in the Research Laboratory of the Pharmaceutical Society of Great Britain (<i>Continued</i>) . . .	317
XXIX.—The Absorption Spectra of Ammonia, Methylamine, Hydroxylamine, Aldoxime, and Acetoxime. By WALTER NOEL HARTLEY, F.R.S., and JAMES J. DOBBIE, D.Sc., M.A. .	318
XXX.—Ammonium Amidosulphate. By EDWARD DIVERS and MASATAKA OGAWA	327
XXXI.—Products of Heating Ammonium Thiosulphate, Sulphites, and Trithionate. By EDWARD DIVERS and MASATAKA OGAWA	335
XXXII.—The Combination of Sulphur Dioxide and Oxygen. By EDWARD JOHN RUSSELL and NORMAN SMITH . . .	340
XXXIII.—Notes on the Estimation of Gaseous Compounds of Sulphur. By EDWARD JOHN RUSSELL	352
XXXIV.—Influence of the Nascent State on the Combination of Dry Carbon Monoxide and Oxygen. By EDWARD JOHN RUSSELL	361
XXXV.—Note on the Refraction and Magnetic Rotation of Hexamethylene, Chlorohexamethylene, and Dichlorohexamethylene. By SYDNEY YOUNG, D.Sc., F.R.S., and EMILY C. FORTEY, B.Sc.	372
XXXVI.—Campholytic and Isolaurenic Acids. By JAMES WALKER and WILLIAM CORMACK	374
XXXVII.—Configuration of the Camphoric Acids. By JAMES WALKER and JOHN K. WOOD	383

	PAGE
XXXVIII.—The Constitution of Camphoric Acid. By JAMES WALKER	390
XXXIX.—The Maximum Pressure of Naphthalene Vapour. By RICHARD WILLIAM ALLEN, M.A., University College, Auckland, N.Z.	400
XL.—The Maximum Pressure of Camphor Vapour. By RICHARD WILLIAM ALLEN, M.A., University College, Auckland, N.Z.	413
XLI.—Apiin and Apigenin. Part II. Note on Vitexin. By ARTHUR GEORGE PERKIN, F.R.S.E.	416
XLII.—Yellow Colouring Principles contained in Various Tannin Matters. Part VII. <i>Arctostaphylos Uva ursi</i> , <i>Hæmatoxylon Campeachianum</i> , <i>Rhus Metopium</i> , <i>Myrica Gale</i> , <i>Coriaria myrtifolia</i> , and <i>Robinia pseudacacia</i> . By ARTHUR GEORGE PERKIN, F.R.S.E.	423
XLIII.—Potassium Nitrito-hydroximidosulphates and the Non-existence of Dihydroxylamine Derivatives. By EDWARD DIVERS, M.D., D.Sc., F.R.S., Emeritus Professor of Chemistry, and TAMEMASA HAGA, D.Sc., Professor of Chemistry in the Tōkyō Imperial University, Japan	432
XLIV.—Identification and Constitution of Fremy's Sulphazotised Salts of Potassium. By EDWARD DIVERS and TAMEMASA HAGA	440
XLV.—Camphonic, Homocamphoric, and Camphononic Acids. By ARTHUR LAPWORTH and EDGAR M. CHAPMAN, Salter's Fellow in the Research Laboratory of the Pharmaceutical Society	446
XLVI.—New Syntheses of Indene. By F. STANLEY KIPPING, Ph.D., D.Sc., F.R.S., and HAROLD HALL, A.I.C.	467
XLVII.—Pilocarpine and the Alkaloids of Jaborandi Leaves. By HOOPER ALBERT DICKINSON JOWETT, D.Sc.	473
XLVIII.—Spectrographic Studies in Tautomerism. The Absorption Curves of the Ethyl Esters of Dibenzoylsuccinic Acid. By WALTER NOEL HARTLEY, F.R.S., and JAMES J. DOBBIE, M.A., D.Sc.	498
XLIX.—The Curves of the Molecular Vibrations of Benzantialdoxime and Benzsynaldoxime. By WALTER NOEL HARTLEY, F.R.S., and JAMES J. DOBBIE, M.A., D.Sc.	510

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

	PAGE
DONATH (EDUARD) and HUGO DITZ. Oxidation of Organic compounds with Alkaline Potassium Permanganate	i, 197
MIXTER (WILLIAM GILBERT). Products of the Explosion of Acetylene	i, 197
SABATIER (PAUL) and JEAN B. SENDRENS. Action of Copper on Acetylene : Formation of Cuprene, a highly condensed Hydrocarbon	i, 197
MINUNNI (GAETANO). Action of Hydroxylamine on Dehydracetic acid	i, 198
SIMON (L. J.). Isopyromucic acid	i, 198
ASTRUO (A.). Acidimetry of Organic Polybasic acids	i, 199
ABERSON (J. H.). Optical Activity of Hydroxypyruvic acid	i, 200
STADT (E. VAN DE). Solubility in Water of Anhydrides of Organic acids	i, 200
MASSOL (GUSTAVE). Acidimetric Value of Substituted Malonic acids compared with that of corresponding Normal Dibasic acids	i, 200
BROWN (A. CRUM) and HERBERT W. BOLAM. Electrolysis of Ethyl Potassium Diethoxysuccinate	i, 201
KOMPPA (GUSTAV). Constitution of saturated Dicarboxylic acids	i, 201
HALLER (ALBIN) and G. BLANC. Synthesis of Camphoric acid by means of Camphoric acid	i, 202
BALBIANO (LUIGI). Camphoric acid	i, 202
NOYES (WILLIAM ALBERT). Camphoric acid : Synthesis of a Camphor-derivative, 2 : 3 : 3-Trimethylcyclopentanone	i, 202
BUCHER (JOHN E.). Action of Ethyl Iodide on Diethyl Tartrate and Sodium Ethoxide	i, 203
ORDONNEAU (CHARLES). Malates and Tartromalates	i, 203
DENIGES (GEORGES). Oxidation of Citric and Malic acids by Potassium Permanganate	i, 204
MAYER (PAUL). Phenylhydrazine derivatives of Glycuronic acid	i, 204
CLOWES (G. H. A.) and BERNHARD TOLLENS. Formaldehyde or Methylene derivatives of acids belonging to the Sugar Group	i, 205
KOHN (LEOPOLD). Action of Potassium Cyanide on Aliphatic Aldehydes	i, 205
BRUYN (C. A. LOBBY DE) and H. C. BIJL. Isodialdane	i, 205
HORNOSTEL (ERICH VON) and EDUARD O. SIEBNER. Condensation of Glyoxal and Isobutaldehyde	i, 206
BAEYER (ADOLF VON) and VICTOR VILLIGER. Action of Caro's Reagent on Ketones	i, 206
FRANKE (ADOLF) and LEOPOLD KOHN. Isobutylideneacetone and its derivatives	i, 206
WIDTSOR (JOHN A.) and BERNHARD TOLLENS. Arabinose, Xylose, and Fucose from Tragacanth	i, 207
BOUVAULT (LOUIS). Complete synthesis of the Phorone derived from Camphoric acid	i, 207
MARCKWALD (WILHELM) and ALEX. MCKENZIE. Resolution of Racemic compounds into Active Components	i, 207
BRUYN (C. A. LOBBY DE) and WILLIAM ALBERDA VAN EKENSTEIN. <i>d</i> -Sorbino- and <i>l</i> -Sorbino- (ψ -Tagatose) and their Configurations	i, 208
GILLOT (H.). Inverting Power of Tartaric, Citric, and Oxalic acids on Sucrose	i, 208
VOTOČEK (EMIL) and J. ŠEBOR. Arabic acid from Beetroots	i, 208
STOLLE (F.). Caramel substances	i, 209
MAMLOCK (LEONARD) and RICHARD WOLFFENSTEIN. Action of Hydrogen Peroxide on Aliphatic Amines	i, 209

	PAGE
KURNAKOFF (NICOLAI A.). Ethylenediamine compounds of Nickel . . .	i, 209
KURNAKOFF (NICOLAI A.) and N. J. GWOSDAREFF. Ethylenediamine compounds of Palladium . . .	i, 209
BEHREND (ROBERT) and HERMANN SCHREIBER. Ethyl β -Bromoamino-crotonate . . .	i, 210
TROGER (JULIUS) and ERICH EWEES. α -Dichlorothiopropanamide . . .	i, 210
BRÜHL (JULIUS WILHELM). [Nitrosoalkylurethanes] . . .	i, 210
ZAWIDZKI (JAN VON). Thiocyanocobaltammonium compounds . . .	i, 210
WALLACH (OTTO). Condensation Products of Rubenic acid [Dithio-oxamide] with Aldehydes and Secondary Bases . . .	i, 210
LEIDIÉ (ÉMILE). Rhodicyanides . . .	i, 212
FRANKE (ADOLF). Transformation of Bisisopropylazimethylene [Isobut-aldazine] into 4:4-Dimethyl-5-isopropylpyrazoline . . .	i, 212
THOMAS (VICTOR). Action of Mercury on Methylene Iodide . . .	i, 213
ESTREICHER (TADÉUSZ). Secondary Butylbenzene . . .	i, 213
WEILER (MAX). Explanation of the Würtz-Fittig Synthesis. IV. Bromomesitylene and Sodium: Mesityl Bromide and Sodium . . .	i, 213
PINNOW (JOHANNES). Acetylation with Acetic Anhydride in Aqueous Solution . . .	i, 214
MINUNNI (GAETANO). Etherification in Presence of Pyridine . . .	i, 214
ROMBURGH (PIETER VAN). Nitration of Dimethylaniline dissolved in Concentrated Sulphuric acid . . .	i, 214
MICHAELIS (AUGUST) and P. SCHINDLER. Action of Thionyl Chloride on Dimethylaniline and Diethylaniline . . .	i, 215
WEDERKIND (EDGAR). Stereochemical Observations on the Reaction between Picric Chloride and Aromatic Amines . . .	i, 216
BAMBERGER (EUGEN) and JENS MÜLLER. Nitrosoamines of Methylated Nitroanilines . . .	i, 217
SCHOLL (ROLAND) and F. KACER. Relation of Fulminic to Isocyanic acid, and the formation of Phenylurethane from Phenol and Mercuric Fulminate . . .	i, 218
RANSOM (JAMES H.). Molecular Rearrangement of <i>o</i> -Aminophenyl Ethyl Carbonate to α -Hydroxyphenylurethane . . .	i, 218
BAMBERGER (EUGEN). Oxidation of Aqueous Solutions of Aromatic Hydroxylamines by Atmospheric Oxygen . . .	i, 220
BAMBERGER (EUGEN) and FRIEDRICH BRADY. Action of Alkalies on Aromatic Hydroxylamines . . .	i, 221
ANGELI (ANGELO) and FRANCESCO ANGELICO. Aromatic Nitro-derivatives . . .	i, 221
EINHORN (ALFRED) and HERMANN PFEIFFER. Action of Sodium and Amyl Alcohol on Phenylaminoacetic acid . . .	i, 221
EINHORN (ALFRED) and HERMANN PFEIFFER. Benzylbutylamines . . .	i, 222
MEYER (JACOB) and MARTIN ROHMER. Action of Formaldehyde on <i>o</i> -Nitroaniline . . .	i, 222
FISCHER (EMIL) and ADOLF WINDAUS. Formation of Quaternary Ammonium compounds in the case of Homologues of Aniline . . .	i, 224
BODROUX (F.). Transformation of Phenyl, <i>p</i> -Tolyl, and Thymyl Acetates into the corresponding Benzoates . . .	i, 224
KOHNER (EMIL). Synthetical Preparation of Iretol and allied Phentetrol derivatives . . .	i, 224
DITZ (HUGO). Bromination of Phenols . . .	i, 225
ČEŽBLSKY (JAROSLAV). A Condensation Product of Trimethylphloroglucinol . . .	i, 225
BLANKSMA (J. J.). Action of Sodium Mono- and Di-sulphide on Aromatic Nitro-compounds . . .	i, 226
IMBERT (HENRI) and A. ASTRUC. Acidimetry . . .	i, 226
TROGER (JULIUS). Action of Ethyl Acetoacetate and Substituted Acetoacetates on <i>p</i> -Aminobenzoic acid in Presence and Absence of Pyridine . . .	i, 226
EINHORN (ALFRED). Reduction of Benzylaminecarboxylic acids [Aminophenylacetic acids] . . .	i, 227
EINHORN (ALFRED) and CARL LADISCH. Reduction of <i>p</i> -Benzylaminecarboxylic acid [<i>p</i> -Aminophenylacetic acid] . . .	i, 227

	PAGE
EINHORN (ALFRED) and STAVROS C. PAPASTAVROS. Reduction of <i>p</i> -Diethylbenzylaminocarboxylic [<i>p</i> -Diethylaminophenylacetic] acid	i, 228
WALLACH (OTTO). Phenylisobutyric and Tolylisobutyric acids	i, 229
BREDT (JULIUS) and H. HOF. Chlorylphthalimide and Bromylphthalimide and their Conversion into Isatoic Anhydride and Acetylanthranil	i, 229
BEIJERINCK (MARTINUS WILLEM). Formation of Indigo from Woad (<i>Isatis tinctoria</i>)	i, 230
ROMBURGH (PIETER VAN). Formation of Indigo from <i>Indigofera</i> and from <i>Marsdenia tinctoria</i>	i, 230
HENTSCHEL (W.). Fusion of Indigotin with Potassium Hydroxide	i, 231
HÖNIG (MAX). Salts of Indigotintrisulphonic acid	i, 231
SIMONIS (HUGO) and G. WENZEL. Tribromocoumarin and its derivatives	i, 231
GABRIEL (SIEGMUND) and JAMES COLMAN. Constitution of Naphthoylbenzoic acid, Naphthanthraquinone, and Naphthanthracene	i, 232
PSCHORR (ROBERT), O. WOLFFES, and W. BUCKOW. Syntheses in the Phenanthrene Series: Synthesis of 1- and 3-Methoxyphenanthrenes	i, 232
PSCHORR (ROBERT). Synthesis in the Phenanthrene Series: ψ -Thebaol	i, 233
STOLLÉ (ROBERT). Hydrogenisation of Ethyl Succinylsuccinate	i, 234
WIDMAN (OSKAR). Usnic acid	i, 235
LIEBERMANN (CARL), P. HÖRING, and FRITZ WIEDERMANN [and, in part, MESSINGER and I. FRÄNCKEL]. Derivatives of Carminic acid	i, 236
OECHSNER DE CONINCK (WILLIAM). Allotropy of Benzophenone	i, 236
MINUNNI (GAETANO). Dibenzylideneacetoneoxime	i, 237
MINUNNI (GAETANO) and C. CARTA-SATTA. Action of Hydroxylamine Hydrochloride on Ketones of the type $\text{CO}(\text{CH}:\text{CHR})_2$ in presence of Sodium Acetate	i, 237
HARPE (B. VON) and STANISLAUS VON KOSTANECKI. 3:3'-Dihydroxyflavone	i, 237
KOSTANECKI (STANISLAUS VON) and TH. SCHMIDT. 2:3':4'-Trihydroxyflavone	i, 238
KOSTANECKI (STANISLAUS VON) and JOSEF TAMBOR [with J. BONGARTZ]. Formation of Flavone from its Decomposition Products	i, 239
VAILLANT (VICTOR). Action of Hydroxylamine and Phenylhydrazine on Dithiobenzoylacetone	i, 239
KLAGES (AUGUST). Conversion of Dihydrocarvone into Carvenone by means of Formic acid	i, 239
BLANC (G.). Amines containing the Camphor nucleus	i, 239
ROOZEBOOM (HENDRIK WILLEM BAKHUIS). Nature of Inactive Carvoxime	i, 240
SEMMLER (FRIEDRICH WILHELM). Tanacetone and its derivatives	i, 240
WALLACH (OTTO) [with EDGARD NEUMANN and WILHELM VON WESTPHALEN]. Compounds of the Fenchone series	i, 241
WALLACH (OTTO) [and A. SCHÄFER]. Oxidation of Pinene	i, 241
CHARABOT (EUGÈNE). Genesis of Terpenes in Lavender	i, 241
JEANCARD and SATIE. Essence of Geranium	i, 242
GUERRET (M.). Composition of East Indian Essence of Sandalwood	i, 242
BOORSMA (S. E.). Curangin, the Glucoside of <i>Curanga amara</i>	i, 243
BRIEGER (LUDWIG). Arrow Poison of Wakamba (German East Africa).	i, 243
MARCHLEWSKI (LEO). Chlorophyll	i, 243
PRUD'HOMME (MAURICE). New Method of Methylation	i, 244
WIDTBOE (JOHN A.) and BERNHARD TOLLENS. Reactions of Methylfurfuraldehyde and Methylpentosans	i, 244
WILLSTÄTTER (RICHARD) and FRITZ IGLAUER. Ketones of the Tropine Group. XIII. Hydroxymethylenetropinone	i, 244
WILLSTÄTTER (RICHARD) and ADOLF BODE. Ketones of the Tropine Group. XIV. Alkali salts of Amino-ketones	i, 245
KOENIGS (WILHELM). Conversion of Cinchona Alkaloids into derivatives of 4-Phenylquinoline	i, 245
VONGERICHTEN (EDUARD). Non-nitrogenous decomposition products of Morphine. VI.	i, 248
FREUND (MARTIN) [and HUGO PREUSS]. Cotarnine	i, 248

	PAGE
WILLSTÄTTER (RICHARD). Action of Halogens on Dimethylpiperidine	i, 249
PICCININI (ANTONIO). Optical Properties of Granatan and Tropane Nuclei	i, 249
KOENIGS (WILHELM). Tetrahydroquinolyl-2-propionic acid	i, 250
RUPE (HANS) and HANS LABHARDT. <i>α</i> -Phenylhydrazine derivatives	i, 250
HISCHMANN (M.). Phenylethylenehydrazine	i, 251
MINUNNI (GAETANO) and C. CARTA-SATTA. New Aldazines and their behaviour towards Benzoyl Chloride	i, 251
MINUNNI (GAETANO) and C. CARTA-SATTA. Replacement of the Aldehyde Group R·CH: by Benzoyl in Hydrazine derivatives	i, 251
STOLZ (FRIEDRICH). So-called Isopyrazole derivatives	i, 252
TRILLAT (AUGUSTE). Derivatives of the Leuco-base, C ₁₂ H ₂₄ N ₂	i, 252
MERZ (VICTOR) and H. STRESSER. Naphthylated Benzidines	i, 253
KEHMANN (FRIEDRICH) [and in part M. STOFFEL and CH. VALENCIEN]. Wandering of the Orthoquinonoid Double Linking in Azonium compounds	i, 254
HANTZSCH (ARTHUR) and G. OSSWALD. Transformation of Colour-bases into Pseudoammonium Hydroxides, Cyanides, and Sulphonic acids	i, 256
STOCK (ALFRED). Constitution of Auramine	i, 258
RUPE (HANS) and HANS LABHARDT. Synthesis of Phenylhydroxytriazoles	i, 258
MINUNNI (GAETANO). Dipiperonaldiphenylhydrotetrazone and its Isomeric Transformations	i, 259
MINUNNI (GAETANO) and GIOVANNI ORTOLEVA. Oxidation of Cinnamaldehydephenylhydrazone	i, 260
MINUNNI (GAETANO) and C. CARTA-SATTA. Oxidation of Salicylaldehydephenylhydrazone	i, 260
GRÖNBERG (MAX). Benzylidine derivatives of Triaminodiphenylamine	i, 260
BÜLOW (CARL). Aliphatic Aromatic Azo- and Tetrazo-derivatives	i, 261
HANTZSCH (ARTHUR) and OSWALD SILBERRAD. Polymerisation products from Ethyl Diazoacetate	i, 261
GOMBERG (MOSES). Diazocaffeine	i, 263
WALLACH (OTTO) and A. TEWES. Mixed Diazoamino-compounds	i, 264
HENDERSON (YANDELL). The Nitrogen which can be split off from Proteids by acids	i, 265
FRIEDMANN (ERNST). The Nitrogen in Primary Albumoses	i, 265
PAULI (W.). Physical alterations in Proteids	i, 265
SCHULZ (FRIEDRICH N.). Oxidation of Crystalline Egg-Albumin	i, 266
MAILLARD (LOUIS). Crystallised Fibrin	i, 266
STORCH (KARL). The Proteids of Cow's Milk	i, 266
HÜFNER (GUSTAV). Formation of Methæmoglobin	i, 267
SCHMIEDEBERG (OSWALD). Nucleic acid from Salmon Milt	i, 267
ABELLOUS (J. E.) and ERNEST GÉRARD. Co-existence of a Reducing Enzyme and an Oxidising Enzyme in the Animal Organism	i, 268
SACHAROFF (N.). Enzymes	i, 268

PART II.

General and Physical Chemistry.

UMOFF (NICOLAI A.). Method for the exhibition of the properties of Polarised Light	ii, 181
LOCKYER (SIR JOSEPH NORMAN). Spectrum of Silicon	ii, 181
NASINI (RAFFAELE), FRANCESCO ANDERLINI, and ROBERTO SALVADORI. New lines in the Ultra Red of the Argon Spectrum	ii, 181
LUTHER (ROBERT). Reversible Photochemical Processes	ii, 181

	PAGE
BLYTHSWOOD (LORD) and E. W. MARCHANT. Absorption of Röntgen's Rays by aqueous solutions of Metallic salts	ii, 182
BECQUEREL (HENRI). Radiations from Radium	ii, 182
BECQUEREL (HENRI). Dispersion of the Radiation of Radium in a Magnetic Field	ii, 183
ROTHMUND (VICTOR). Electromotive Force and Chemical Equilibrium	ii, 183
COHEN (ERNST). A new kind of Transition Element	ii, 183
COHEN (ERNST). Theory of the Transition Cell of the Third Kind	ii, 184
COHEN (ERNST). Alleged identity of Red and Yellow Mercuric Oxides. I.	ii, 184
TOMMASINA (THOMAS). Metallic Crystallisation by Electrical Transport of certain Metals in Distilled Water	ii, 185
MARSHALL (HUGH). Polarisation Phenomena observed in Quantitative Electrolytic Determinations	ii, 185
VOEGE (ADOLPH L.). Electrolytic reduction of Potassium Chlorate	ii, 185
BANCROFT (WILDER D.). The Dilution Law	ii, 186
MEYER (STEFAN). Molecular susceptibility of the salts of the Rare Earths	ii, 186
LIEBKNECHT (OTTO) and A. P. WILLS. Molecular susceptibility of the Paramagnetic salts of the Iron Group	ii, 187
JONES (HARRY CLARY). Electrolytic dissociation of certain salts in Methyl and Ethyl alcohols as measured by the boiling point method	ii, 187
FLEURY (GUSTAVE [CLEMENT]). Specific heat of some Organic substances	ii, 188
BAYLEY (THOMAS). Atomic Weights and Physical Properties	ii, 188
MÜLLER (WOLF). Change in the transition point of Ammonium Nitrate at 32° through addition of Potassium Nitrate	ii, 188
COHEN (ERNST). New method of determining transition temperatures	ii, 188
LAAR (J. J. VAN). Partial association of Liquid Molecules	ii, 189
GALT (ALEXANDER). [Negative Heat of Formation of Alloys of Zinc and Copper]	ii, 189
BERTHELOT (MARCELLIN PIERRE EUGÈNE). [Thermochemistry of] the Uric Acid Series	ii, 189
ABEGG (RICHARD). Heat of dissociation of Violuric acid and of Water	ii, 190
TOLLOCEKO (STANISLAW). Antimony Trichloride in Cryoscopy	ii, 190
WILDERMANN (MEYER). Real and apparent Freezing Points and Cryoscopic Methods	ii, 191
NATANSON (LADISLAUS). Thermokinetic Properties of Solutions	ii, 191
CAUBET (F.). Liquefaction of Gaseous Mixtures	ii, 191
VERSCHAFFELT (J. E.). Deviations from Boyle's Law of Mixtures of Hydrogen and Carbon Dioxide	ii, 192
BLEIER (OTTO) and LEOPOLD KOHN. Determination of Vapour Density under arbitrary pressure. II.	ii, 192
GÖCKEL (HEINEICH). New Pyknometer for the determination of the specific gravity of light liquids	ii, 193
HALLER (ALBIN) and PAUL TH. MÜLLER. Molecular Volume of Camphor derivatives	ii, 193
DUTOIT (PAUL) and LOUIS FRIDERICH. Surface Tension of Organic Liquids	ii, 194
BROWN (ALEXANDER CRUM). Nernst's Osmotic experiment and a definition of Osmotic pressure	ii, 194
WIEDEBURG (OTTO). Theory of Diffusion	ii, 194
EWAN (THOMAS). Osmotic pressure of Concentrated Solutions	ii, 195
BANCROFT (WILDER DWIGHT). Hydrates in Solution	ii, 195
BRUNI (GIUSEPPE). Solid Solutions and Isomorphous Mixtures	ii, 196
BRUNI (GIUSEPPE). Reciprocal Solubility of Liquids	ii, 196
EULER (HANS). Solubility of Ethyl Acetate in Aqueous Salt Solutions	ii, 196
WIND (C. H.). Gibbs' Phase Rule	ii, 197
LE CHATELIER (HENRY [LOUIS]). Application of the Phase Rule to Alloys and Rocks	ii, 197
BRUNI (GIUSEPPE) and F. GORNI. Physical Equilibrium in mixtures of Isomorphous substances	ii, 197
KAY (SYDNEY A.). Equilibrium between Sulphuric acid and Sulphates in Aqueous Solution	ii, 198

	PAGE
MEYERHOFFER (WILHELM) and A. P. SAUNDERS. Reciprocal Salt Pairs.	
II. Equilibrium Phenomena in presence of a Double Salt	ii, 198
GIBSON (JOHN). Characteristics of certain Chemical Reactions	ii, 198
WALKER (JAMES). Velocity of Graded Reactions	ii, 198
BOUDOUARD (OCTAVE). Numerical Laws of Chemical Equilibrium	ii, 199
WEGSCHEIDER (RUDOLF). Kinetics of Reactions with Auxiliary Reactions	ii, 199
HEMPTINNE (ALEXANDER DE). Velocities of Reaction	ii, 199
GOLDSCHMIDT (HEINRICH) [with ANTON MESSERSCHMITT]. Velocity of Reaction in Heterogeneous Systems	ii, 200
WILDERMANN (MEYER). The Velocity of Reaction before complete Equilibrium and before Transition Points. True meaning of the Law of Chemical Equilibrium of Heterogeneous Systems. Reactions in Heterogeneous Systems	ii, 200
JORISSEN (W. P.) and LODEWYK THEODORUS REICHER. Influence of Catalytic Agents on the Oxidation of Oxalic acid solutions	ii, 200
ARRHENIUS (SVANTE). Change in the strength of weak acids by the addition of salts	ii, 201
DONNAN (FREDERICK GEORGE). Nature of Soap Emulsions	ii, 201
VRIENS (JOHANNES GERARDUS CORNELIS). Experiments on Adsorption	ii, 202

Inorganic Chemistry.

MAREK (W.). Distillation of Water	ii, 202
RINNE (FRIEDRICH). Nature of Water of Crystallisation	ii, 202
MARSHALL (HUGH). Action of Persulphates on Iodine	ii, 203
BLIER (OTTO) and LEOPOLD KOHN. Vapour Density of Sulphur	ii, 203
BERNTSEN (AUGUST) and MAX BAZLEN. Hyposulphurous acid	ii, 203
KNORRE (GEORG VON) and KURT ARNDT. Oxidation of Hydroxylamine	ii, 204
BIJLERT (A. VAN). Action of very dilute Nitric acid [on Metals]	ii, 204
GRIMM (RUD.). Spontaneous Combustion of Coals	ii, 205
ESTRICHNER (TADEUSZ). Solubility of Argon and Helium in Water	ii, 205
BROCHET (ANDRÉ). Electrolysis of Potassium Chlorate	ii, 205
ALVISI (UGO). New Explosive and Detonating Materials	ii, 205
TAYLOR (W. W.). Crystalline Hydrates of Sodium Thiosulphate	ii, 206
KAHLENBERG (LOUIS). Preparation of Metallic Lithium	ii, 206
MOURAOUR (HENRI). Action of Magnesium on Saline Solutions	ii, 206
OUVRARD (LEON [VICTOR RENÉ]). Metallic Borates	ii, 206
OUVRARD (LEON [VICTOR RENÉ]). Borates of Zinc, Manganese, Nickel, and Cobalt	ii, 207
SCHÜPPHAUS (ROBERT C.). Behaviour of Zinc Oxide at High Temperatures	ii, 207
MARSHALL (HUGH). Hydrolysis of Thallic Sulphate	ii, 207
POZZI-ESCOT (E.). New Microchemical Reactions of Copper	ii, 207
VITALI (DIOSCORIDE). Action of Bromine on Copper salts in presence of Alkali Hydroxides. Test for Copper salts	ii, 208
FRANÇOIS (MAURICE). Action of Ammonia on Diammonio-mercuric Iodide	ii, 208
THIRLE (HERMANN). [Luminosity of Mixtures of Thoria and Ceria]	ii, 208
MUTHMANN (WILHELM) and R. BÖHM. Separation of Gadolinite and Earths, and the Preparation of pure Yttria	ii, 209
BENEDICKS (CARL). Gadolinium	ii, 209
DAWSON (HARRY M.) and P. WILLIAMS. Stable Hydrates of Manganese Chloride above 0°	ii, 210
TANATAR (SIMEON M.). Peroxides	ii, 211
WHITNEY (WILLIS RODNEY). Nature of the change from Violet to Green in Solutions of Chromium salts	ii, 211
GUICHARD (MARCEL). A New Crystalline Molybdenum Sulphide	ii, 211
COHEN (ERNST) and C. VAN EIJK. Enantiotropy of Tin. II.	ii, 212
COHEN (ERNST). Enantiotropy of Tin. III.	ii, 212
SCHNEIDER (R.). Bismuth Suboxide and Subsulphide	ii, 212

BEHRENS (THEODOR HEINRICH). Isomorphous compounds of Gold and Mercury	ii, 213
BREDIG (GEORG). Preparation of Colloidal Metallic Solutions by the Disintegrating Action of an Electric Discharge	ii, 213
BREDIG (GEORG) and R. MÜLLER VON BERNECK. Inorganic Ferments. I. Catalytic Action of Platinum, and the Chemical Dynamics of Hydrogen Peroxide	ii, 213
MIOLATI (ARTURO). Platinum Tetrachloride	ii, 214
SHIELDS (JOHN). Nature of Palladium Hydrogen	ii, 215

Mineralogical Chemistry.

BEMMELEN (JACOBUS M. VAN) [with C. HOITSEMA and EDUARD A. KLOBBIE]. Accumulation of Iron in Peat	ii, 215
ENGLER (CARL). Formation of Petroleum	ii, 216
PENFIELD (SAMUEL LEWIS). Graftonite, a New Mineral	ii, 216
COLOMBA (LUIGI). Anhydrite and Gypsum Deposits at Oulx, Piedmont	ii, 216
SCHMIDT (CARL). [Celestite from Baltschiederthal, Switzerland]	ii, 217
BUSZ (KARL H. E. G.). [Mineral Analyses]	ii, 217
TSCHERMAK (GUSTAV). Theory of Tourmaline Mixtures	ii, 217
MEHA (JOSEF). Kelyphite	ii, 218
D'ACHIARDI (GIOVANNI). Allophane from Italy	ii, 218
LURDECKE (OTTO). New Occurrence of Laumontite	ii, 218
CLARKE (FRANK W.) and GEORGE STEIGER. Action of Ammonium Chloride on Analcite and Leucite	ii, 219
DUPARC (LOUIS) and F. PEARCE. Granitoid Rocks from Cape Marsa	ii, 219
JOHN (CONRAD HEINRICH VON). Eruptive Rocks from the Salzkammergut	ii, 219
WASHINGTON (HENRY S.). Analyses of Italian Volcanic Rocks	ii, 220
DUPARC (LOUIS) and F. PEARCE. Plagioliparites of Cape Marsa, Algeria	ii, 220
ANTIPOFF (J. A.). Meteorites from Jamyscheff and Tubil River, Siberia	ii, 220
GÜNTHER (R. T.) and J. J. MANLEY. Waters of the Salt Lake of Urmi, Persia	ii, 220

Physiological Chemistry.

WINTERNITZ (HUGO). Action of certain derivatives of Morpine on Respiration in Man	ii, 221
GUILLOZ (TH.). Action of the Constant Current on the Respiration of Surviving Muscle	ii, 221
WAHL (FRITZ). Carbonic Oxide in Tobacco Smoke	ii, 221
HALDANE (JOHN SCOTT). The supposed Oxidation of Carbonic Oxide in the Living Body	ii, 221
HEDIN (SVEN GUSTAV). The Influence of Animal Membranes on the diffusion of various substances	ii, 221
HARRIS (DAVID FRASER). Pressure Filtration of Proteids	ii, 222
RUMPF (THEODOR) and O. SCHLUMM. Metabolism in a Vegetarian	ii, 222
CAMERER (WILLIAM) and FRIEDRICH SÖLDNER. Metabolism in Children	ii, 222
HAGEMANN (OSKAR). Metabolism in Ruminants	ii, 222
NOËL-PATON (DIARMID), J. CRAUFORD DUNLOP and R. S. AITCHISON. Metabolism of Phosphorus	ii, 222
LEIPZIGER (RICHARD). Metabolism with Edestin	ii, 223
LINDERMANN, (W.). Metabolism during Poisoning with Pulegone	ii, 223
ABDERHALDEN (EMIL). Absorption and Excretion of Iron	ii, 223
HÉDON (E.). Absorption of Sugars in the Intestine	ii, 223
FRIEDENTHAL (HANS). Digestion of Starch in the Stomach of Carnivora	ii, 224
LÜHRIG (H.). Relative Digestibility of certain Fats in the Human Intestine	ii, 224
BERTARELLI (E.). Nutritive Value of Margarine compared with Butter	ii, 224
EDMUNDS (WALTER). Effects of Thyroid Feeding on Monkeys	ii, 224

	PAGE
BLUM (FRITZ). The Thyroid as a Poison Removing Organ	ii, 224
CHARRIN (ALBERT and LEVADITI). Defence of the Organism against the Toxic Properties of Glandular Secretions	ii, 224
BORUTTAU (H.). Physiology of the Suprarenal Capsules	ii, 225
ROSEMAN (RUDOLF). Influence of Alcohol on Milk Formation	ii, 225
BOTTAZZI (FILIPPO) and I. CAPPELLI. Sodium and Potassium in the Red Corpuscles of the Blood of Animals of different Species and in Cases of Anæmia caused by Bleeding	ii, 225
BOTTAZZI (FILIPPO) and I. CAPPELLI. Sodium and Potassium in the Red Corpuscles of the Blood during Fasting	ii, 225
GAUTIER (ÉMILE (JUSTIN ARMAND)). Localisation, Elimination, and Origin of Arsenic in Animals	ii, 226
BASKERVILLE (CHARLES). Universal Distribution of Titanium	ii, 226
ABELOUS (J. E.) and ERNEST GÉRARD. Transformation of Nitrobenzene into Aniline by a Reducing and Oxidising Enzyme in the Animal Organism	ii, 226
FREUND (WALTHER). Excretion of Sulphur in Infants	ii, 226
THOMPSON (WILLIAM HENRY). Influence of Peptone and Albumoses on Urinary Secretion	ii, 226
CLEMENS (P.). Diazo-reactions of Urine	ii, 227
FAUVEL (PIERRE). The Pigment of the <i>Arenicola</i>	ii, 227
LOEB (JACQUES). Ion-proteid compounds; the poisonous character of pure Sodium Chloride	ii, 227
FESSEL (F.). Physiological Action of Bromine	ii, 227
THOMPSON (WILLIAM HENRY). Physiological Action of Protamines and their Decomposition Products	ii, 227
IMPENS (E.). Physiological Action of Morphine and its Allies	ii, 227
STEPHENS (J. W. W.). Hæmolytic Action of Snake Toxins and Toxic Sera	ii, 227
THOMSON (R. S.) and ALEXANDER R. FERGUSON. Sandy Matter from the Human Intestine	ii, 227
SHAW (H. BATTY). Milky Serous Effusions	ii, 229
LÜTHJE (HUGO). Acetonuria	ii, 229
CAMMIDGE (P. J.) and ARCHIBALD E. GARROD. Excretion of Diamines in Cystinuria	ii, 229

Chemistry of Vegetable Physiology and Agriculture.

ROSENSTIEHL (AUGUSTE). Reproduction of Yeast without Fermentation in a limited supply of Air	ii, 229
HEINZELMANN (G.). Decomposition of Diastase during Fermentation	ii, 230
O'SULLIVAN (JAMES). Rate of Alcoholic Fermentation	ii, 230
ISACHENKO (B.). Influence of Metals on Broth-cultures of Bacteria	ii, 230
SCHATTENFROH (ARTHUR) and R. GRASSBERGER. Butyric acid Fermenta- tion	ii, 230
MAASSEN (ALBERT). Bacteria which produce Esters	ii, 231
OMELIANSKY (V.). Magnesia-gypsum as a Solid Medium for the Cultiva- tion of Nitrifying Organisms	ii, 232
JENSEN (HJALMAR). Denitrification Bacteria and Sugar	ii, 232
SEWERIN (S. A.). Decomposition of Nitrates by Bacteria	ii, 232
KOLKOWITZ (R.). Soil Bacteria	ii, 233
BOURQUELOT (ÉMILE) and HENRI HÉRISSEY. Soluble Ferments produced during the Generation of Seeds with Horny Albumen	ii, 233
LUTZ (L.). Nutrition of Plants with Organic Nitrogenous compounds	ii, 233
PRIANISCHNIKOFF (DMITRI N.). Regeneration of Proteids from their products of decomposition	ii, 233
WOODS (ALBERT F.). Decomposition of Chlorophyll by Oxidising Enzymes	ii, 234
CZAPEK (FRIEDRICH). Root Secretions	ii, 234
NOBBE (FRIEDRICH) and LORENZ HILTNER. Action of Leguminous Nodules in Water Cultures	ii, 234
ALBO (G.). Physiological functions of Solanine	ii, 234

	PAGE
TSCHERMAK (ERICH). Distribution of Lithium in Plants	ii, 235
MACDOUGAL (D. T.). Copper in Plants	ii, 235
DEMARÇAY (EUGÈNE [ANATOLE]). Presence of Vanadium, Molybdenum, and Chromium in Plants	ii, 235
GRIFFITHS (ARTHUR BOWER). Green Pigment of <i>Ananila muscaria</i>	ii, 235
COUPIN (HENRI). Poisonous properties of Sodium Chloride and Sea Water towards Plants	ii, 236
ARENANDER (E. O.). Effect of Food on the quality of Milk	ii, 236
HILLS (JOSEF LAWRENCE). Effect of Food on the quality of Butter	ii, 236
SCHIEBE (ANTON). Natural Butter showing the Sesamé Oil Reaction	ii, 236
VIETH (PAUL). Sesamé Oil Reaction in Pure Butter	ii, 236
THORPE (THOMAS EDWARD). Effect of Feeding Cotton or Sesamé Cake on Butter	ii, 237
BRUTSKUS (B. K.). Nutritive value of Asparagine	ii, 237
PRJANISCHNIKOFF (DMITRI N.). Vegetation experiments in 1897	ii, 237
HOLDEFLEISS (FRIEDRICH). Influence of Fermentation on the value of Hay	ii, 238
DEHÉRAIN (PIERRE P.) and E. DEMOUSSY. Cultivation of White Lupins	ii, 238
GORDON (JAMES S.). Experiments on Potatoes	ii, 238
BEHRENS (JOHANNES). Tobacco Plant	ii, 239
JENKINS (EDWARD H.). Experiments with Tobacco Fertilisers, 1892—1896	ii, 239
JENKINS (EDWARD H.). Effect of Fertilisers on the composition of Wrap- per Leaf Tobacco	ii, 239
MALDEN (W. J.). Manurial experiments on Permanent Pasture	ii, 240
BAFFLESER (P.). Field experiments for determining the general manurial requirements of typical soils with reference to chemical soil analysis	ii, 240
ULBRICHT (RICHARD). Pot experiments on the action of Lime and Mag- nesia in Burnt Lime and Marls	ii, 240

Analytical Chemistry.

VOGTHER (M.). Ammonium Dithiocarbonate as a substitute for Hydrogen and Ammonium Sulphides	ii, 241
COLSON (ALBERT). Volumetric estimation of Hydrogen: diffusion of a Solid into a Gas	ii, 241
DITZ (HUGO) and HEINRICH KNÖPFELMACHER. Iodometric process for the analysis of a mixture of Chlorate and Hypochloride	ii, 241
KÜSTER (FRIEDRICH W.) and A. THIEL. Estimation of Sulphuric acid in the presence of Iron	ii, 242
HÖNIG (MAX). Estimation of Nitric acid in Water	ii, 242
DEVENTER (CHARLES MARIUS VAN). Estimation of Nitrates	ii, 242
ERDMANN (HUGO). Detection and estimation of very small quantities of Nitrous acid	ii, 243
HERZFELD (ALEXANDER). Estimation of Phosphoric acid soluble in a 2 per cent. solution of Citric acid	ii, 243
HOFFMEISTER (WILHELM). Phosphates and the Humic acid process	ii, 244
SCHOLTZ (W.). Biological detection of Arsenic in Skin, Hair, Perspiration, and Urine	ii, 244
DIETZE (F.). Stannous Chloride and Bettendorf's Test for Arsenic	ii, 244
ENELL (HENRIK). Bettendorf's Arsenic Test	ii, 244
FRERICHS (G.). Bettendorf's Arsenic Test	ii, 244
AUSTIN (MARTHA). Constitution of the Ammonium Magnesium Arsenate of Analysis	ii, 245
HERTING (OTTO). Estimation of Carbon, Copper, and Manganese in Iron	ii, 245
HUYSE (A. C.). Microchemical detection of Potassium, Rubidium, Cæsium, Indium, and Thiosulphates	ii, 245
LETEUR (F.). Precipitation of Silver Chloride by Dimercurous-ammonium Chloride	ii, 246
PASSON (MAX). Estimation of Calcium by the Citrate method	ii, 246

	PAGE
BROWNING (PHILIP EMBURY). Estimation of Thallium as the Acid and Normal Sulphates	ii, 247
VITALI (DIOSCORIDE). Detection of Copper	ii, 247
SCHUMACHER and W. L. JUNG. Estimation of Mercury in Urine	ii, 247
STOCK (ALFRED). New Method of Estimating Aluminium	ii, 247
BRAKES (JAS.). Estimation of Titanic acid in Iron Ore	ii, 248
MARBURG (RICHARD). Quantitative Separation of Tin, Antimony, and Arsenic	ii, 248
NEUMANN (ALBERT). Simplification of the Phenylhydrazine Test for Sugars	ii, 248
GRÜNHUT (LEO) and SEVERIN H. E. RIEBER. Estimation of Sucrose in Condensed Milk	ii, 249
EURY (J.). Source of Error in the Detection of Sugar in Urine by means of Fehling's Solution	ii, 249
STOLLE (F.). Caramel Substances. II. Estimation of Caramel in Aqueous Solutions by means of the Spectroscope	ii, 249
MANN (KONRAD). Estimation of Cellulose in Fæces	ii, 250
KELLNER (OSCAR), FR. HERING, and O. ZAHN. König's Process for the Estimation of Crude Fibre free from Pentosan	ii, 250
SCHÜTZ (J.). Separation and Estimation of Formic, Acetic, Propionic, and Butyric acids	ii, 250
FREUNDLICH (I.). Determination of the Solidifying Point of Fatty acids	ii, 250
BULL (HENRIK). Estimation of Unsaturated Fatty acids in Fish Oils	ii, 250
ORDONNEAU (CHARLES). [Estimation of Calcium Malate in Crude Tartar]	ii, 250
WÖRNER (EMIL). Estimation of Uric acid based on Precipitation as Ammonium Urate	ii, 251
FAHBIEN (WILHELM). The Inner Saponification Number	ii, 251
TIMPE (H.). Constancy in the Composition of Cow's Milk and Detection of its Adulterations	ii, 251
SCHULZE (BERNHARD). Effect of Milk Preservatives on Milk Fat	ii, 251
WERDER (J.). Estimation of Fatty Matter in Butter by Gerber's Process	ii, 252
RAIKOW (P. N.) and N. TSCHERWENIWANOW. Bechi and Halphen's Colour Reactions for the Identification of Cotton Seed Oil	ii, 252
WIJS (J. J. A.). Macassar Oil	ii, 252
KREIS (HANS) and ERNET RUDIN. Detection of Phytosterol and Cholesterol in Fats	ii, 252

INDEX OF AUTHORS' NAMES.

A.

Abderhalden, E., ii, 223.
 Abegg, R., ii, 190.
 Abelous, J. E., and E. Gérard, i, 268;
 ii, 226.
 Aberson, J. H., i, 200.
 Aitchison, R. S. See D. Noël-
 Paton.
 Alberda van Ekenstein, W. See
 C. A. L. de Bruyn.
 Albo, G., ii, 234.
 Allen, R. W., TRANS., 400, 413.
 Alvisi, U., ii, 205.
 Anderlini, F. See R. Nasini.
 Angeli, A., and F. Angelico, i, 221.
 Antipoff, J. A., ii, 220.
 Arenander, E. O., ii, 236.
 Arndt, K. See G. von Knorre.
 Arrhenius, S., ii, 201.
 Astruc, A., i, 199.
 Astruc, A. See also H. Imbert.
 Austin, M., ii, 245.

B.

Baessler, P., ii, 240.
 Baeyer, A. von, and V. Villiger,
 i, 206.
 Balbiano, L., i, 202.
 Bamberger, E., i, 220.
 Bamberger, E., and F. Brady, i, 221.
 Bamberger, E., and J. Müller, i, 217.
 Bancroft, W. D., ii, 186, 195.
 Baskerville, C., ii, 226.
 Bayley, T., ii, 188.
 Bazlen, M. See A. Bernthsen.
 Becquerel, H., ii, 182, 183.
 Behrend, R., and H. Schreiber,
 i, 210.
 Behrens, J., ii, 239.
 Behrens, T. H., ii, 218.
 Beijerinck, M. W., i, 230.
 Remmelen, J. M. van, C. Hoitsema,
 and E. A. Klobbie, ii, 215.
 Benedicks, C., ii, 209.

Bernthsen, A., and M. Bazlen,
 ii, 208.
 Bertarelli, E., ii, 224.
 Berthelot, M. P. E., ii, 189.
 Bijl, H. C. See C. A. L. de Bruyn.
 Bijlert, A. van, ii, 204.
 Blanc, G., i, 239.
 Blanc, G. See also A. Haller.
 Blanksma, J. J., i, 226.
 Bleier, O., and L. Kohn, ii, 192, 208.
 Blum, F., ii, 224.
 Blythswood, Lord, and E. W. Mar-
 chant, ii, 182.
 Bode, A. See R. Willstätter.
 Bodroux, F., i, 224.
 Böhm, R. See W. Muthmann.
 Bolam, H. W. See A. C. Brown.
 Bongartz, J. See S. von Kosta-
 necki.
 Boorsma, S. E., i, 243.
 Boruttau, H., ii, 225.
 Bottazzi, F., and J. Cappelli, ii, 225.
 Boudouard, O., ii, 199.
 Bourquelot, E., and H. Hérissé, ii,
 233.
 Bouveault, L., i, 207.
 Brady, F. See E. Bamberger.
 Brakes, J., ii, 248.
 Bredig, G., ii, 213.
 Bredig, G., and R. Müller von Ber-
 neck, ii, 213.
 Bredt, J., and H. Hof, i, 229.
 Brieger, L., i, 243.
 Brochet, A., ii, 205.
 Brown, A. C., ii, 194.
 Brown, A. C., and H. W. Bolam,
 i, 201.
 Browning, P. E., ii, 247.
 Brühl, J. W., i, 210.
 Bruni, G., ii, 196.
 Bruni, G., and F. Gorni, ii, 197.
 Brutskus, B. K., ii, 237.
 Bruyn, C. A. L. de, and W. Alberda
 van Ekenstein, i, 208.
 Bruyn, C. A. L. de, and H. C. Bijl,
 i, 205.

Bucher, J. E., i, 208.
 Buckow, W. See R. Paschorr.
 Bülow, C., i, 261.
 Bull, H., ii, 250.
 Busz, K., ii, 217.

C.

Camerer, W., and F. Söldner, ii, 222.
 Cammidge, P. J., and A. E. Garrod, ii, 229.
 Cappelli, I. See F. Bottazzi.
 Carta-Satta, C. See G. Minunni.
 Caubet, F., ii, 191.
 Čechelsky, J., i, 225.
 Chapman, E. M. See A. Lapworth.
 Charabot, E., i, 241.
 Charrin, A., and Levaditi, ii, 224.
 Clarke, F. W., and G. Steiger, ii, 219.
 Clemens, P., ii, 227.
 Clowes, G. H. A., and B. Tollens, i, 205.
 Cohen, E., ii, 183, 184, 188, 212.
 Cohen, E., and C. van Eijk, ii, 212.
 Colman, J. See S. Gabriel.
 Colomba, L., ii, 216.
 Colson, A., ii, 241.
 Cormack, W. See J. Walker.
 Coupin, H., ii, 236.
 Czapek, F., ii, 234.

D.

D'Achiardi, G., ii, 218.
 Dawson, H. M., and P. Williams, ii, 210.
 Dehérain, P. P., and E. Demoussy, ii, 238.
 Demarçay, E., ii, 235.
 Demoussy, E. See also P. P. Dehérain.
 Denigès, G., i, 204.
 Deventer, C. M. van, ii, 242.
 Dietze, F., ii, 244.
 Ditz, H., i, 225.
 Ditz, H., and H. Knöpfelmacher, ii, 241.
 Ditz, H. See E. Donath.
 Divers, E., and T. Haga, TRANS., 432, 440.
 Divers, E., and M. Ogawa, TRANS., 327, 335.
 Dobbie, J. J. See W. N. Hartley.
 Donath, E., and H. Ditz, i, 197.
 Donnan, F. G., ii, 201.
 Dunlop, J. C. See D. Noël-Paton.
 Duparc, L., and F. Pearce, ii, 219, 220.
 Dutoit, P., and L. Friderich, ii, 194.

E.

Edmunds, W., ii, 224.
 Eijk, C. van. See E. Cohen.
 Einhorn, A., i, 227.
 Einhorn, A., and O. Ladisch, i, 227.
 Einhorn, A., and S. C. Papastavros, i, 228.
 Einhorn, A., and H. Pfeiffer, i, 221, 222.
 Enell, H., ii, 244.
 Engler, C., ii, 216.
 Erdmann, H., ii, 243.
 Estrieher, T., i, 213; ii, 205.
 Euler, H., ii, 196.
 Eury, J., ii, 249.
 Ewan, T., ii, 195.
 Ewers, E. See J. Troeger.

F.

Fahrion, W., ii, 251.
 Fauvel, P., ii, 227.
 Ferguson, A. R. See R. S. Thomsen.
 Fessel, F., ii, 227.
 Fischer, E., and A. Windaus, i, 224.
 Fleury, G., ii, 188.
 Fortey, E. C. See S. Young.
 Fränckel, I. See C. Liebermann.
 François, M., ii, 208.
 Franke, A., i, 212.
 Franke, A., and L. Kohn, i, 206.
 Frerichs, G., ii, 244.
 Freund, M., and H. Preuss, i, 243.
 Freund, W., ii, 226.
 Freundlich, I., ii, 250.
 Friderich, L. See P. Dutoit.
 Friedenthal, H., ii, 224.
 Friedmann, E., i, 265.

G.

Gabriel, S., and J. Colman, i, 232.
 Galt, A., ii, 189.
 Garrod, A. E. See P. J. Cammidge.
 Gautier, A., ii, 226.
 Gérard, E. See J. E. Abelous.
 Gibson, J., ii, 198.
 Gillot, H., i, 208.
 Göckel, H., ii, 193.
 Goldschmidt, H., and A. Misserschmitt, ii, 200.
 Gomberg, M., i, 263.
 Gordon, J. S., ii, 238.
 Gorni, F. See G. Bruni.
 Grassberger, R. See A. Schattenschroff.
 Griffiths, A. B., ii, 235.
 Grimm, R., ii, 205.

Groneberg, M., i, 260.
 Grünhut, L., and S. H. R. Riiber,
 ii, 249.
 Günther, R. T., and J. J. Manley,
 ii, 220.
 Guerbet, M., i, 242.
 Guichard, M., ii, 211.
 Guilloz, T., ii, 221.
 Gwosdareff, N. J. See N. A. Kurnakoff.

H.

Haga, T. See E. Diversa.
 Hagemann, O., ii, 222.
 Haldane, J. S., ii, 221.
 Hall, H. See F. S. Kipping.
 Haller, A., and G. Blanc, i, 202.
 Haller, A., and P. T. Muller, ii, 193.
 Hantzsch, A., and G. Osswald, i, 256.
 Hantzsch, A., and O. Silberrad,
 i, 261.
 Harpe, B. von, and S. von Kostanecki, i, 237.
 Harris, D. F., ii, 222.
 Hartley, W. N., and J. J. Dobbie,
 TRANS., 318, 498, 510.
 Hedin, S. G., ii, 221.
 Hédon, E., ii, 223.
 Heinzelmann, G., ii, 230.
 Hemptinne, A. de, ii, 199.
 Henderson, Y., i, 265.
 Hentschel, W., i, 231.
 Hering, F. See O. Kellnes.
 Hérissay, H. See É. Bourquelot.
 Herting, O., ii, 245.
 Herzfeld, A., ii, 243.
 Hills, J. L., ii, 236.
 Hiltner, L. See F. Nobbe.
 Hischmann, M., i, 251.
 Hönig, M., i, 231; ii, 242.
 Höring, P. See C. Liebermann.
 Hof, H. See J. Brecht.
 Hoffmeister, W., ii, 244.
 Hoitsema, C. See J. M. van Bemmel.
 Holdfleiss, F., ii, 238.
 Hornbostel, E. von, and E. O. Siebner, i, 206.
 Hüfner, G., i, 267.
 Huysse, A. C., ii, 245.

I.

Iglauer, F. See R. Willstätter.
 Imbert, H., and A. Astruc, i, 226.
 Impens, E., ii, 227.
 Isachenko, B., ii, 230.

J.

Jaffe, A. See F. W. Richardson.
 Jeancard and Satie, i, 242.
 Jenkins, E. H., ii, 239.
 Jensen, H., ii, 232.
 John, C. H. von, ii, 219.
 Jones, H. C., ii, 187.
 Jorissen, W. P., and L. T. Reicher,
 ii, 200.
 Jowett, H. A. D., TRANS., 473.
 Jung, W. L. See Schumacher.

K.

Kacer, F. See R. Scholl.
 Kahlenberg, L., ii, 206.
 Kay, S. A., ii, 198.
 Kehrman, F., M. Stoffel, and C. Valencien, i, 254.
 Kellner, O., F. Hering, and O. Zahn,
 ii, 250.
 Kipping, F. S., and H. Hall, TRANS.,
 467.
 Klages, A., i, 239.
 Klobbie, E. A. See J. M. van Bemmel.
 Knöpfelmacher, H. See H. Ditz.
 Knorre, G. von, and K. Arndt, ii, 204.
 Koenigs, W., i, 245, 250.
 Kohn, L., i, 205.
 Kohn, L. See also O. Bleier, A. Franke.
 Kohner, E., i, 224.
 Kolkwitz, R., ii, 238.
 Komppa, G., i, 201.
 Kostanecki, S. von, and T. Schmidt,
 i, 238.
 Kostanecki, S. von, J. Tambor,
 and J. Bongartz, i, 239.
 Kostanecki, S. von. See also B. von Harpe.
 Kreis, H., and E. Rudin, ii, 252.
 Küster, F. W., and A. Thiel, ii, 242.
 Kurnakoff, N. A., i, 209.
 Kurnakoff, N. A., and N. J. Gwosdareff, i, 209.

L.

Laar, J. J. van, ii, 189.
 Labhardt, L. See H. Rupe.
 Ladisch, O. See A. Einhorn.
 Lapworth, A., and E. M. Chapman,
 TRANS., 446.
 Le Chatelier, H., ii, 197.
 Leidié, É., i, 212.
 Leipziger, R., ii, 223.
 Leteur, F., ii, 246.

Levaditi. See A. Charrin.
 Liebermann, C., P. Höring, F.
 Wiedermann, Messinger, and I.
 Fränckel, i, 236.
 Liebknecht, O., and A. P. Wills,
 ii, 187.
 Lindemann, W., ii, 223.
 Lockyer, Sir J. N., ii, 181.
 Loeb, J., ii, 227.
 Lüdecke, O., ii, 218.
 Lührig, H., ii, 224.
 Luthje, H., ii, 229.
 Luther, R., ii, 181.
 Lutz, L., ii, 238.

M.

Maassen, A., ii, 231.
 MacDougal, D. T., ii, 235.
 McKenzie, A. See W. Marckwald.
 Maillard, L., i, 266.
 Malden, W. J., ii, 240.
 Mamlock, L., and R. Wolfenstein,
 i, 209.
 Manley, J. J. See R. T. Günther.
 Mann, K., ii, 250.
 Marburg, R., ii, 248.
 Marchant, E. W. See Lord Blyth-
 wood.
 Marchlewski, L., i, 243.
 Marckwald, W., and A. McKenzie,
 i, 207.
 Marek, W., ii, 202.
 Marshall, H., ii, 185, 203, 207.
 Massol, G., i, 200.
 Mayer, P., i, 204.
 Merz, V., and H. Strasser, i, 253.
 Messerschmitt, A. See H. Gold-
 schmidt.
 Messinger. See C. Liebermann.
 Meyer, J., and M. Rohmer, i, 222.
 Meyer, S., ii, 186.
 Meyerhoffer, W., and A. P. Saun-
 ders, ii, 198.
 Michaelis, A., and P. Schindler,
 i, 215.
 Minunni, G., i, 198, 214, 237, 259.
 Minunni, G., and C. Carta-Satta,
 i, 237, 251, 260.
 Minunni, G., and G. Ortoleva,
 i, 260.
 Miolati, A., ii, 214.
 Mixer, W. G., i, 197.
 Mouraour, H., ii, 206.
 Mrha, J., ii, 218.
 Müller, J. See E. Bamberger.
 Müller, W., ii, 188.
 Müller von Berneck, R. See G.
 Bredig.
 Muller, P. T. See A. Haller.

Muthmann, W., and R. Böhm,
 ii, 209.

N.

Nasini, R., F. Anderlini, and R.
 Salvadori, ii, 181.
 Natanson, L., ii, 191.
 Neumann, A., ii, 248.
 Neumann, E. See O. Wallach.
 Nobbe, F., and L. Hiltner, ii, 234.
 Noël-Paton, D., J. C. Dunlop, and
 R. S. Aitchison, ii, 222.
 Nogin, K. See A. A. Shukoff.
 Noyes, W. A., i, 202.

O.

Oechsner de Coninck, W., i, 236.
 Ogawa, M. See E. Diversa.
 Omeliansky, V., ii, 232.
 Ordonneau, C., i, 203; ii, 250.
 Ortoleva, G. See G. Minunni.
 Osswald, G. See A. Hantzsch.
 O'Sullivan, J., ii, 230.
 Ouvrard, L., ii, 206, 207.

P.

Papastavros, S. C. See A. Einhorn.
 Passon, M., ii, 246.
 Pauli, W., i, 265.
 Pearce, F. See L. Duparc.
 Penfield, S. L., ii, 216.
 Perkin, A. G., TRANS, 416, 423.
 Pfeiffer, H. See A. Einhorn.
 Piccinini, A., i, 249.
 Pinnow, J., i, 214.
 Pozzi-Escot, E., ii, 207.
 Preuss, H. See M. Freund.
 Pranischnikoff, D. N., ii, 233, 237.
 Prud'homme, M., i, 244.
 Pschorr, R., i, 233.
 Pschorr, R., O. Wolfes, and W.
 Buckow, i, 232.

R.

Raikow, P. N., and N. Tscherveni-
 wanow, ii, 252.
 Ransom, J. H., i, 218.
 Reicher, L. T. See W. P. Jorissen.
 Riiber, S. H. R. See L. Grünhut.
 Rinne, F., ii, 202.
 Rohmer, M. See J. Meyer.
 Romburgh, P. van, i, 214, 230.
 Roozeboom, H. W. B., i, 240.

Rosemann, R., ii, 225.
 Rosenstiehl, A., ii, 229.
 Rothmund, V., ii, 183.
 Rudin, E. See H. Kreis.
 Rumpf, T., and O. Schlumm, ii, 222.
 Rupe, H., and H. Labhardt, i, 250,
 258.
 Russell, E. J., TRANS., 352, 361.
 Russell, E. J., and N. Smith, TRANS.,
 340.

S.

Sabatier, P., and J. B. Senderens,
 i, 197.
 Sacharoff, N., i, 268.
 Salvadori, R. See R. Nasini.
 Satie. See Jeancard.
 Saunders, A. P. See W. Meyer-
 hoffer.
 Schäfer, A. See O. Wallach.
 Schattenfroh, A., and R. Grass-
 berger, ii, 230.
 Scheibe, A., ii, 236.
 Schindler, P. See A. Michaelis.
 Schlumm, O. See T. Rumpf.
 Schmidt, C., ii, 217.
 Schmidt, T. See S. von Kosta-
 necki.
 Schmiedeberg, O., i, 267.
 Schneider, R., ii, 212.
 Scholl, R., and F. Kacer, i, 218.
 Scholtz, W., ii, 244.
 Schreiber, H. See R. Behrend.
 Schütpphaus, R. C., ii, 207.
 Schütz, J., ii, 250.
 Schulz, F. N., i, 266.
 Schulze, B., ii, 251.
 Schumacher, and W. L. Jung, ii, 247.
 Šebor, J. See E. Votoček.
 Semmler, F. W., i, 240.
 Senderens, J. B. See P. Sabatier.
 Sewerin, S. A., ii, 232.
 Shaw, H. B., ii, 229.
 Shields, J., ii, 215.
 Siebner, E. O. See E. von Horn-
 bostel.
 Silberrad, O. See A. Hantzsch.
 Simon, L. J., i, 198.
 Simonis, H., and G. Wenzel, i, 231.
 Smith, N. See E. J. Russell.
 Söldner, F. See W. Camerer.
 Stadt, E. vande, i, 200.
 Steiger, G. See F. W. Clarke.
 Stephens, J. W. W., ii, 227.
 Stock, A., i, 258; ii, 247.
 Stoffel, M. See F. Kehrman.
 Stolle, F., i, 209; ii, 249.
 Stollé, R., i, 234.
 Stolz, F., i, 252.

Storch, K., i, 266.
 Strasser, H. See V. Merz.

T.

Tambor, J. See S. von Kostanecki.
 Tanatar, S. M., ii, 211.
 Taylor, W. W., ii, 206.
 Tewes, A. See O. Wallach.
 Thiel, A. See F. W. Küster.
 Thiele, H., ii, 208.
 Thomas, V., i, 213.
 Thompson, W. H., ii, 226, 227.
 Thomson, R. S., and A. R. Fergu-
 son, ii, 227.
 Thorpe, T. E., ii, 237.
 Timpe, H., ii, 251.
 Tollens, B. See G. H. A. Clowes,
 J. A. Widtsoe.
 Tolloczko, S., ii, 190.
 Tommasina, T., ii, 185.
 Trillat, A., i, 252.
 Troeger, J., i, 226.
 Troeger, J., and E. Ewers, i, 210.
 Tschermak, E., ii, 235.
 Tschermak, G., ii, 217.
 Tscherniwanow, N. See P. N.
 Raikow.

U.

Ulbricht, R., ii, 240.
 Umoff, N. A., ii, 181.

V.

Vaillant, V., i, 239.
 Valencien, C. See F. Kehrman.
 Verschaffelt, J. E., ii, 192.
 Vieth, P., ii, 236.
 Villiger, P. See A. von Baeyer.
 Vitali, D., ii, 208, 247.
 Voegelé, A. L., ii, 185.
 Vogtherr, M., ii, 241.
 Vongerichten, E., i, 248.
 Votoček, E., and J. Šebor, i, 208.
 Vriens, J. G. C., ii, 202.

W.

Wahl, F., ii, 221.
 Walker, J., TRANS., 390; ii, 198.
 Walker, J., and W. Cormack,
 TRANS., 374.
 Walker, J., and J. K. Wood, TRANS.,
 383.
 Wallach, O., i, 210, 229.

- Wallach, O., E. Neumann, and W. von Westphalen, i, 241.
 Wallach, O., and A. Schäfer, i, 241.
 Wallach, O., and A. Tewes, i, 264.
 Washington, H. S., ii, 220.
 Wedekind, E., i, 216.
 Wegscheider, R., ii, 199.
 Weiler, M., i, 213.
 Wenzel, G. See H. Simonis.
 Werder, J., ii, 252.
 Westphalen, W. von. See O. Wallach.
 Whitney, W. R., ii, 211.
 Widman, O., i, 235.
 Widdsoe, J. A., and B. Tollens, i, 207, 244.
 Wiedeberg, O., ii, 194.
 Wiedermann, F. See C. Liebermann.
 Wijs, J. J. A., ii, 252.
 Wildermann, M., ii, 191, 200.
 Williams, P. See H. M. Dawson.
 Wills, A. P. See O. Liebknecht.
 Willstätter, R., i, 249.
 Willstätter, R., and A. Bode, i, 245.
 Willstätter, R., and F. Iglaue, i, 244.
 Wind, C. H., ii, 197.
 Windaus, A. See E. Fischer.
 Winternitz, H., ii, 221.
 Wörner, E., ii, 251.
 Wolfes, O. See R. Pschorr.
 Wolfenstein, R. See L. Mamlock.
 Wood, J. K. See J. Walker.
 Woods, A. F., ii, 234.

Y.

Young, S., and E. C. Fortey, TRANS , 372.

Z.

Zahn, O. See O. Kellner.
 Zawidzki, J. von, i, 210.

ERRATUM.

VOL. LXXVIII. (ABST., 1900).

PART I.

Page	Line
184	10* for "oil of cumin" read "oil of caraway."

* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
Bunsen Memorial Lecture. By Sir HENRY ROSCOE, B.A., Ph.D., D.C.L., LL.D., D.Sc., F.R.S., Hon. M.D. (Heidelberg), Corresponding Member of the French Academy of Science, Emeritus Professor of Chemistry in Victoria University, Vice-Chancellor of the University of London	513
Annual General Meeting	555
Obituary Notices	591
L.—Electrolysis of the Nitrogen Hydrides and of Hydroxyl- amine. By EMERIQUE CHARLES SZARVASY, Ph.D.	603
LI.—Constitution of Amarine, of its supposed Dialkyl- and Diacyl-derivatives, and of Isamarine. By FRANCIS R. JAPP, F.R.S., and JAMES MOIR, M.A., B.Sc.	608
LII.—Vapour Density of Dried Mercurous Chloride. By H. BREERETON BAKER, M.A.	646
LIII.—Preparation of Pure Hydrobromic Acid. By ALEXANDER SCOTT	648
LIV.—A New Sulphide of Arsenic. By ALEXANDER SCOTT	651
LV.—Researches on the Alkyl-substituted Succinic Acids. Part II. <i>s</i> -Dipropyl, <i>s</i> -Diisopropyl, and <i>aa</i> ₁ -Propylisopropyl- succinic Acids. By WILLIAM A. BONE and CHARLES H. G. SPRANKLING	654
LVI.—The Interaction between Sulphites and Nitrites. By EDWARD DIVERS and TAMEMASA HAGA	
LVII.—Presence of Invertase in some Plants of the <i>Gramineæ</i> . Part I. By JAMES O'SULLIVAN	691
LVIII.—Mannogalactan and Lævulomannan. Two New Poly- saccharides. By JULIAN LEVETT BAKER and THOMAS HENRY POPE	696
LIX.—The Dissociation Constant of Azoimide (Hydrazoic Acid). By CHARLES ALFRED WEST, Assoc.R.C.S.	705
LX.—New Glucoside from Willow Bark. By HOOPER ALBERT DICKINSON JOWETT, D.Sc.	707
LXI.—Bromination of Benzeneazophenol. By J. T. HEWITT and W. G. ASTON	712

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

	PAGE
TISTSCHENKO (WETSCHIASLAW È.) [with A. GABOUNIA, M. G. KISSELEFF, N. MARAZOUEFF, and N. N. PUSHIN]. Action of Amalgamated Aluminium on alcohols. Aluminium Alkylloxides	i, 269
NAGEL (ISKAR). Rancidity of Fats	i, 271
GEITEL (ADOLF C.) and G. VAN DER WANT. Japan Wax	i, 271
VANDEVELDE (ALB. J. J.). Substituted Dibasic acids. Conversion of an acid Chloride into an Anhydride by the action of Haloid acids	i, 272
ROSENHEIM (ARTHUR) and HERMANN ITZIG. Some Complex salts of Tartaric and Malic acids and their Specific Rotatory Power. II.	i, 272
DENIGÈS (GEORGES). Formation of Crystalline Manganese Oxalate by the Oxidation of Citric acid with Potassium Permanganate	i, 274
WOLF (C. G. L.). Melting Point of Chloral Hydrate	i, 274
KOHN (LEOPOLD). Molecular Weight of the Aldols	i, 274
PAULY (HERMANN) and HANS LIECK. Mesityl Oxide	i, 274
TIEMANN (FERDINAND). Methyl-2-heptene-4-one-6 and the synthesis of an Aliphatic Isogermanic acid	i, 275
HOFFER (HANS). Electro-synthesis of Diketones and Ketones	i, 275
GACH (FRIEDRICH). Acetylacetone	i, 276
JESSER (LEOPOLD). Determination of the Reducing Power of Raw Sugar	i, 276
STOLLE (F.). Is the Diminution of the Rate of Inversion caused by the Presence of Normal salts of Inverting acids due to the Formation of Esters?	i, 277
SCHWEITZER (RUDOLF). Colouring Matters contained in "Sugar Colours" and their Detection	i, 277
KIJNER (NIC. M.). Action of Silver Oxide and of Hydroxylamine on Bromoamines	i, 277
HOEHNEL (M.). Halogen derivatives of Hexamethylenetetramine (Urotropine)	i, 279
SCHIFF (HUGO) [with MARIO BETTI and GIULIO MARZICHI]. Polyaspartic acids	i, 279
FLEMING (HUGO). Preparation of Carbamide from Guanidine	i, 280
JACOBSON (PAUL) and ARTHUR LOEB. Pentabromobenzene	i, 281
BAMBERGER (EUGEN) and ADOLF HILL. Oxidation of Aromatic Iodides	i, 281
HABER (FRITZ). Gradual Electrolytic Reduction of Nitrobenzene with limited Cathode Potential	i, 281
HABER (FRITZ) and CARL SCHMIDT. Electrolytic Reduction of Nitrobenzene	i, 282
DUDEN (PAUL). Benzenesulphonamides of Primary Bases: The use of Hinsberg's Reaction for Determination of Structure	i, 282
WILLGERODT (CONRAD) and PETER SCHLÖSSER. 1-Naphthylidochloride, 1-Iodosonaphthalene, 4:4'-Diiodo-1:1'-dinaphthyl, 1-Naphthyl-phenyliodonium Hydroxide and derivatives thereof	i, 282
WEILER (MAX). Synthesis of Homologues of Diphenylmethane by Oxidation of Toluene and its Homologues	i, 283
KLAUDY (JOSEF) and ISIDOR FINK. New Aromatic Hydrocarbon, $C_{24}H_{18}$, from Mineral Oil	i, 284
HIGBEE (HOWARD H.). Double Halogen salts of Antimony with Aniline and the Toluidines	i, 285
GOLDSCHMIDT (CARL). Action of Formaldehyde on Anilides	i, 285

	PAGE
MENNE (ERNST). ψ -Carbamides	i, 286
BEHREND (ROBERT) and FRED C. MEYER. Action of Phenylcarbimide on Ethyl β -Aminocrotonate	i, 287
PECHMANN (HANS VON) and OTTO ANSEL. Vinylideneoxanilide and its Homologues	i, 287
REVERDIN (FRÉDÉRIC) and PIERRE CRÉPIEU. 4:1-Chloronaphthylamine	i, 288
THIELE (JOHANNES) and HEINRICH EICHWEDE. Constitution of Tribromophenol Bromide ("Tribromphenolbrom")	i, 288
ORNDORFF (WILLIAM R.) and D. A. MORTON. Anethole and its Isomerides	i, 289
HILLYER (HOMER W.). Action of Picryl Chloride on Catechol in presence of Alkalis	i, 289
MERZ (VICTOR) and H. STRASSER. Preparation of Resorcinol Monomethyl Ether	i, 289
DELANGE (RAYMOND). Eugenol, Safrole, and Propylcatechol	i, 289
WEIDEL (HUGO) and JACQUES POLLAK. Nitroso-derivatives of the Phloroglucinol Ethers	i, 290
WEISWEILLER (GUSTAV). Ethylphloroglucinol and other derivatives of Ethylbenzene	i, 291
WEIDEL (HUGO) and JACQUES POLLAK. Action of Nitrous acid on Methylphloroglucinol	i, 291
BRUNNMAYR (HEINRICH). Preparation of Dimethyl-1:2:3:5-phenetrol	i, 291
BRAKEN (WILHELM) and EDUARD BUCHNER. ψ -Phenylacetic acid	i, 292
HOLLIS (FRED S.). <i>s-p</i> -Nitro- <i>o</i> -sulphobenzoic Chloride	i, 292
WHEELER (HENRY LORD) [with MUNSON D. ATWATER, TREAT B. JOHNSON, and BAYARD BARNES]. Rearrangement of Imino-ethers. II.	i, 293
PECHMANN (HANS VON) [with JULIUS OBERMILLER]. Decomposition of Benzenylmethyliminochloride	i, 294
VORLÄNDER (DANIEL) and RUDOLF VON SCHILLING. Isomeric Mono-esters of Phenylglycine- <i>o</i> -carboxylic acid	i, 295
VORLÄNDER (DANIEL) and H. WEISSBRENNER. Action of Ammonia and Aniline on Phenylglycine- <i>o</i> -carboxylic acid	i, 295
VORLÄNDER (DANIEL) and H. WEISSBRENNER. Acetylation of Phenylglycine- <i>o</i> -carboxylic acid	i, 295
TWITCHELL (ERNST). Benzenestearosulphonic acid [Sulphophenylstearic acid] and other Sulphonic acids containing the Stearyl Group	i, 296
GRAEBE (CARL). Constitution of Chrysenic acid	i, 296
JAUBERT (GEORGE F.). Preparation of Naphthalic acid	i, 296
SEVERIN (SMILE). 2:4-Dichloro-2-dimethylaminobenzoylbenzoic acid	i, 296
DIECKMANN (WILHELM). Nitroso-compounds derived from Cyclic 2-Ketocarboxylic Esters (Bianitroso-2-carboxylic Esters and α -Oximinodicarboxylic acids)	i, 297
DIECKMANN (WILHELM) and A. GROENEVELD. Nitroso-compound from Ethyl Methyl-2-ketopentamethylenecarboxylate obtained by the condensation of Ethyl β -Methyladipate, and their constitution	i, 297
FOSSE (R.). Acetals from Phenols	i, 298
THIELE (JOHANNES). Ketone Reactions of Cyclopentadiene	i, 298
DERBIEN (E.). Solubility of Benzophenone	i, 299
THIELE (JOHANNES) and J. MEISENHEIMER. Addition of Hydrogen Cyanide to Quinone	i, 299
SCHMIDT (JULIUS). Action of Nitrogen Trioxide on α -Naphthaquinone	i, 299
MANCHOT (WILHELM). Spontaneous Oxidation, "Autoxidation," and formation of Active Oxygen ("Sauerstoffaktivierung")	i, 300
ÉTARD (ALEXANDRE). Oxidation of the nature of Dehydrogenation by means of Ferricyanides: Oxidation of Camphor	i, 301
HALLER (ALBIN). Reaction between Aromatic Aldehydes and the Sodium derivative of Borneol	i, 301
MINGUIN (JULES). Resolution of Racemic Benzylidenecamphor: Isomorphism of the active components	i, 301
DUDEN (PAUL) and ALFRED E. MACINTYRE. Vinylamine of the Camphor Group	i, 302

	PAGE
TINGLE (JOHN BISHOP) and ALFRED TINGL. Action of Ethyl Oxalate on Camphor. V.	i, 302
CHARABOT (EUGENE). Genesis of compounds of the Menthol Series in Plants	i, 303
WILLSTÄTTER (RICHARD) and RUDOLF LESSING. Benzenesulphamino-compounds of Primary bases	i, 304
BOORSMA (S. E.). Curangin, the Glucoside of <i>Curanga amara</i>	i, 304
OESTERLE (O. A.). Aloe-emodin and <i>Frangula</i> -emodin	i, 304
SCHIMANSKY (ST.). Cause of the change of colour of Congo-red by the action of acids	i, 305
LINDAUER (GUSTAV). A Glycol and Aldol of the Furfuran Series	i, 305
SANDELIN (S. S.). Furfuroylacetic acid and Methyl Furfuryl Ketone	i, 305
SANDELIN (S. S.). Furfurylsuccinic acid [Furfurylsuccinic acid]	i, 306
SANDELIN (S. S.). Furfurylsuccinic acid [Furfurylcarbinylsuccinic acid]	i, 306
PETRENKO-KRITSCHENKO (PAVEL IW.). Hydroxylamine derivatives of Tetrahydropyrone compounds	i, 306
PETRENKO-KRITSCHENKO (PAVEL I.) and E. ELTCHANINOFF. Synthesis of Tetrahydropyrone derivatives	i, 307
CORN (EDOARDO). Bisphenylethylenetetrahydropyronecarboxylic acid	i, 307
BLOCH (M.) and STANISLAUS VON KOSTANECKI. 2-Methyl-7-hydroxypheno-3-pyrone (2-Methyl-7-hydroxychromone)	i, 308
WEIDEL (HUGO) and FRANZ WENZEL. Condensation of Homologous Phloroglucinols with Salicylaldehyde	i, 308
EVANS (THOMAS). Ricinine	i, 309
MINUNNI (GAETANO) and GIOVANNI ORTOLEVA. Chloro-derivatives of Oxygenated Alkaloids. Action of Chlorine on Strychnine in Glacial Acetic acid solution	i, 309
BAMBERGER (EUGEN) and G. DJIERDJIAN. Pytrolealdehyde	i, 309
WIKANDER (HJALMAR). Derivatives of 5:6:8-Trimethylquinoline	i, 310
CAMPS (RUDOLF). Syntheses of 2- and 4-Hydroxyquinolines	i, 310
LIEBERMANN (CARL T.) and in part E. HOYER. Malonic acid derivatives of Dibromo- α -naphthaquinone	i, 310
BOUGAULT (J.). Action of Iodine on Antipyrine	i, 311
BOUGAULT (J.). Iodoantipyrine	i, 312
FICHTER (FRITZ), JOSEPH ENZENAUER, and EMIL UELLENBERG. 1-Phenyl-4-methylpyrazolone	i, 312
PECHMANN (HANS VON). Action of Diazoethane on Picryl Acetate	i, 313
MERZ (VICTOR) and H. STRASSER. Diaminodixenylamine	i, 313
DOEBNER (OSCAR [GUSTAV]). Glauconic Acids. II.	i, 313
MERZ (VICTOR) and H. STRASSER. Action of Tetramethyldiaminobenzophenone on α -Dinaphthylbenzidine	i, 314
PECHMANN (HANS VON) and WILHELM BAUER. Dihydro-1:2:3:4-tetrazine	i, 314
BUSCH (MAX) and CARL HEINRICHS. Conversion of Tetrazine into Triazole derivatives	i, 314
JAUBERT (GEORGE F.). Diazotization of Safranine	i, 315
BIETRZYCKI (AUGUSTIN). Oxidation of Hydrazobenzene in Alkaline Alcoholic solution by Atmospheric Oxygen	i, 315
HANTZSCH (ARTHUR) and J. S. SMYTHE. Transformation of Bromodiazonium Chlorides into Chlorodiazonium Bromides	i, 315
BRIEGER (LUDWIG). Cause of Ehrlich's Diazo-reaction [in Urine]	i, 316
MEUNIER (LOUIS) and A. RIGOT. Cuprous salt of Diazoaminobenzene	i, 316
HAUSMANN (WALTHER). The Condition of Nitrogen in the Proteid Molecule	i, 317
EUSTIS (ALLAN C.). Proportion of Basic Nitrogen in Elastin	i, 317
GIES (WILLIAM J.). Mucin from Bone	i, 317
LEVENE (P. A.). Mucin	i, 317
LEVENE (P. A.) and LAFAYETTE B. MENDEL. Basic Decomposition Products of Edestin	i, 318
LEATHERS (J. B.). Ovarial Mucoids	i, 318

	PAGE
HALDANE (JOHN SCOTT). Cyano-methæmoglobin and Photo-methæmoglobin	i, 318
ARNOLD (V). Neutral Hæmatin	i, 318
KÜSTER (WILLIAM). Decomposition products of Hæmatin	i, 319
NEUMANN (ALBERT). Preparation of <i>a</i> - and <i>b</i> -Nucleic Acids and of Nucleothymic Acid	i, 319
JONES (WALTER). Thymine	i, 319
THUDICHUM (JOHN L. W.). Reactions of Phrenosin, the Cerebro-galactoside from the Human Brain	i, 319
BOURQUELOT (ÉMILE) and HENRI HÉRISSEY. Seminase, a new Enzyme	i, 320
ALBERT (ROBERT) and EDUARD BUCHNER. Precipitation of Zymase from Yeast Extract	i, 320

PART II.

General and Physical Chemistry.

GUYE (PHILIPPE A.) and EMILY ASTON. Rotatory Power of active Valeric acid	ii, 253
ABEGG (RICHARD). Silver Germ or Subhaloid Theory	ii, 253
LUTHER (ROBERT). The nature of the Latent Image and the so-called Eder Test	ii, 253
CURIE (P.) and SKŁODOWSKA CURIE. Electric Charge of the Devisible Rays of Radium	ii, 254
WEDELL-WEDRELLSBORG (P. S.). Validity of Maxwell's Equations	ii, 254
SCHWEY (ANTON). Validity of Maxwell's Equations	ii, 254
BARNES (H. T.). Inversion of Hepta- and Hexa-hydrates of Zinc Sulphate in the Clark Cell	ii, 254
KÜSTER (FRIEDRICH W.) and F. CROTOGINO. Potential of the Iodine Electrode	ii, 255
KÜSTER (FRIEDRICH W.) and A. THIEL. Potential of Silver in Solutions of its mixed Halogen salts	ii, 255
MORGAN (J. LIVINGSTON R.). Three additions to the Kohlrausch-Ostwald Conductivity Method	ii, 255
LARSEN (ABSAION). Influence of Temperature on the Electrical Conductivity of dilute Amalgams, and the Solubility of Metals in Mercury	ii, 255
KOWALEWSKY (W. L. VON). Stannic Chloride in Aqueous Solutions	ii, 256
ABEGG (RICHARD) and CL. IMMERWAHR. Electrochemical properties of Silver Fluoride and of Fluorine	ii, 256
RICHARDS (THEODORE W.), EDWARD COLLINS, and GEORGE W. HEIMROD. Electrochemical Equivalent of Copper and Silver	ii, 256
PEASE (H. C.). Electrochemical Equivalent of Carbon	ii, 257
HABER (FRITZ). Electrical Reduction of Non-electrolytes	ii, 257
KÖNIGSBERGER (JOH.). Magnetic Susceptibility	ii, 258
REYCHLER (ALBERT). Thermochemical Law of Maximum Work	ii, 258
GAUTIER (ARMAND). Tubular Furnace giving Fixed Temperatures adjustable at will	ii, 258
LADENBURG (ALBERT) and C. KRÜGEL. Measurement of Low Temperatures	ii, 258
BEHN (U.). Specific Heat of Metals at Low Temperatures	ii, 259
BEHN (U.). Specific Heat of Metals, Graphite, and a few Alloys at Low Temperatures	ii, 259
KUHARA (MITSURU) and MASUMI CHIKASHIGE. Determination of melting points	ii, 260

	PAGE
SALZER (THEODOR). Regularities in melting points	ii, 260
BEHN (U.). Heat of Sublimation of Carbon Dioxide and Heat of Vaporisation of Air	ii, 260
THIEL (A.). Heat of Neutralisation and Electrolytic Dissociation	ii, 260
MASSOL (GUSTAVE). Thermochemistry of normal Adipic acid	ii, 260
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Isomerism of Thiocyanic derivatives	ii, 261
LEROY (EMILE). Meconin, Opianic and Hemipianic acids	ii, 261
WILDERMANN (MEYER). Freezing point method in Dilute Solutions, and the Theory of Solutions	ii, 262
JONES (HARRY C.) and VICTOR J. CHAMBERS. Abnormal depressions of the freezing point produced by Chlorides and Bromides of the Alkaline Earths	ii, 262
AUWERS (KARL) [and, in part, W. BARTSCH, F. H. BETTERIDGE, MAX DOHNN, and H. M. SMITH]. Cryoscopic Observations	ii, 262
MEYER (KIRSTINE) (née B. JERRUM). Corresponding States	ii, 263
GULDBERG (CATO M.). Absolute Molecular Volumes	ii, 264
LEWIS (GILBERT NEWTON). Development and application of a general equation for Free Energy and Physicochemical Equilibrium	ii, 264
VAUBEL (WILHELM). Chemical Affinity	ii, 264
SCHÜMANN (M.). Diazotisation and the Affinity Constants of Nitrous acid	ii, 264
PÉLABON (H.). Chemical Equilibrium in a System of Four Gases	ii, 265
KONOWALOFF (DMITRI P.). Relations between Ammonia and salts in Aqueous Solutions	ii, 265
BRUYN (B. R. DE). Equilibrium in Systems containing an Alkali salt, Water, and Alcohol	ii, 266
DUDEN (PAUL). A case of Chemical Equilibrium suitable for demonstration	ii, 267
BOHR (CHRISTIAN). Solubility of Carbon Dioxide in Alcohol between -67° and $+45^{\circ}$. Invasion and Evasion Coefficients at 0°	ii, 267
WALKER (JAMES). Relation between the Dissociation Constant of weak acids and the Hydrolysis of their Alkali salts	ii, 268
BRUNER (LUDWIK). Hydrolysis of salt solutions	ii, 268
EULER (HANS). Catalysis with Normal salts	ii, 269
BREDIG (GEORG) and A. COHEN. Colloidal solutions	ii, 269
COOPER (HERMANN C.). Stereoisomerides and Racemic compounds	ii, 269
BUONI (GIUSEPPE). Recognition of Racemic compounds	ii, 269
SALZER (THEODOR). Water of Crystallisation. II.	ii, 270
KAHLENBERG (LOUIS). Relation of the taste of Acid Salts to their degree of dissociation	ii, 270
DROSSBACH (G. PAUL). Laboratory Apparatus for Roasting large quantities of material	ii, 270

Inorganic Chemistry.

MOISSAN (HENRI). Volumetric composition of Hydrogen Fluoride	ii, 271
SCHALL (CARL). Vapour Density of Sulphur	ii, 271
SCHUMANN (HANS). Products of the action of Sulphur Dioxide on Ammonia	ii, 271
NORRIS (JAMES F.) and HENRY FAY. Reduction of Selenium Dioxide by Sodium Thiosulphate	ii, 272
NORRIS (JAMES F.), HENRY FAY, and D. W. EDGERLY. Preparation of Pure Tellurium	ii, 272
LENER (VICTOR) and J. LIVINGSTON R. MORGAN. Specific Gravity and Electrical Resistance of Tellurium	ii, 273
LINEBARGER (CHARLES ELIJAH). Surface Tensions of Mixtures of Sulphuric acid and Water, and the molecular Mass of Sulphuric acid	ii, 273
HANTZSCH (ARTHUR RUDOLF). A New Nitrogen Iodide, N_2I	ii, 274

	PAGE
HUGOT (C.). Nitrogen Iodide	ii, 274
VAUBEL (WILHELM). The molecule of Carbon and the supposed Negative Heat of Formation of various Carbon compounds	ii, 274
HEMPEL (WALTHER) and VON HAAS. Preparation of Amorphous Silicon, Silicon Chloride, and Thiosilicates	ii, 275
LEBEAU (PAUL). Preparation of Arsenides, Antimonides, and Alloys of the Alkali Metals	ii, 276
BROCHET (ANDRÉ). Electrolytic formation of Potassium Chlorate	ii, 276
SETON (A. M.) and K. L. STEVENSON. Presence of Potassium Nitrite in Brown Powder residues when the Powder is burnt in air under ordinary pressure	ii, 276
FRAPS (GEORGE S.). Isomeric Potassium Sodium Sulphites	ii, 276
KURNAKOFF (NICOLAI S.). Compounds of Metals among themselves	ii, 277
MARSHALL (HUGH). Persulphates of Rubidium, Cæsium, and Thallium	ii, 277
KAHLBAUM (GEORG W. A.). Melting Point of Lithium	ii, 277
FORCRAND (ROBERT DE). Action of Hydrogen Peroxide on Barium Hydroxide	ii, 277
BRYANT (EDWARD G.). Action of Metallic Magnesium on Water	ii, 277
BREDIG (GEORG). Colloidal Cadmium	ii, 278
VANINO (LUDWIG) and OTTO HAUSER. Action of Hydrogen Sulphide on Lead Peroxide	ii, 279
SCHUYTEN (M. C.). A new type of Ammoniocopper Chromate	ii, 279
HOFMANN (KARL A.) and EDUARD C. MARBURG. Mercury derivatives of Nitrogen compounds	ii, 279
FRANÇOIS (MAURICE). Anhydrous Dimercuriammonium Iodide, Amorphous and Crystalline	ii, 280
MOISSAN (HENRI). Preparation and properties of a Manganese Perfluoride	ii, 280
WOBBE (WILLY). Ferric Oxide Solution obtained by Dialysis	ii, 281
MARONNEAU (GEORGES). Preparation of the Phosphides of Iron, Nickel, Cobalt, and Chromium	ii, 281
HODGKINSON (W. R. EATON), R. WARING, and A. P. H. DESBOROUGH. Alloys of Platinum and Palladium with Cadmium, Zinc, and Magnesium	ii, 282
ROSENHEIM (ARTHUR) and HERRMANN ITZIG. Complex Palladium salts	ii, 282

Mineralogical Chemistry.

SALIGNY (ALFONS O.). Roumanian Petroleum	ii, 282
HIGGIN (ALFRED J.). Melonite from South Australia	ii, 283
KEMP (JAMES F.). Titaniferous Magnetites	ii, 283
DOHERTY (WILLIAM MICHAEL). Manganese Nodules from New South Wales	ii, 283
SCHWEINFURTH (G.) and L. LEWIN. Egyptian Soda Valleys	ii, 283
HOFF (JACOBUS H. VAN'T) and D. CHIARAVIGLIO. Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XV. Formation of Glauberite at 25°	ii, 284
HOFF (JACOBUS H. VAN'T) and N. KASSATKIN. Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XVI. Hydrate of Magnesium Potassium Sulphate, $Mg_4K_2(SO_4)_5 + 5H_2O$	ii, 284
WILSON (HAROLD A.). Formation of Oceanic Salt Deposits, particularly of the Stassfurt Beds. XVII. A relationship between the composition of Solutions of Sodium Chloride and Potassium Chloride saturated at 25°	ii, 285
BUTUREANU (VASILE C.). Constitution and Classification of Silicates	ii, 285
IWASAKI (C.). Augite from Yoneyama, Japan	ii, 286

	PAGE
WEIBULL (MATS). Westanite, Pyrophyllite, and Kaolinite from Westana, Sweden	ii, 286
LINCK (GOTTLÖB ED.). [Minerals in] the Pegmatites of the Upper Veltlin	ii, 286
WEIBULL (MATS). Ransäsite	ii, 287
MANASSE (E.). Tourmaline from Elba	ii, 287
POLLOCK (JAMES HOLMS). Kieselghur from Co. Antrim	ii, 287
PRESTON (H. L.). Illinois Gulch Meteorite	ii, 287
LIVERSIDGE (ARCHIBALD), WILLIAM SKEY, and G. GREY. Composition and properties of the Mineral Waters of Australasia	ii, 288

Physiological Chemistry.

PLAVEC (W.). Action of the Blood Gases on Breathing	ii, 288
ATHANASIU (J.). Respiration in the Frog	ii, 288
MENDEL (LAFAYETTE B.) and HOLMES C. JACKSON. Nitrogenous Metabolism after Splenectomy	ii, 288
ATWATER (WIEBUR OLIN). Nutritive Value of Alcohol	ii, 288
RÖHMANN (FRANZ). Digestion of Carbohydrates by <i>Aplysia</i>	ii, 289
ROSENHEIM (OTTO) and PHILIP SCHIDROWITZ. Comparative Analyses of, and Digestion Experiments with, White and Whole-meal Breads	ii, 289
PODA (HEINRICH) and WILHELM PRÄUSNITZ. Plasmon	ii, 289
ABERHALDEN (EMIL). Assimilation of Iron	ii, 289
COHNHEIM (OTTO). Absorption in the Small Intestine	ii, 289
MÜLLER (PAUL). Reduction of Cholesterol to Coprosterol in the Human Intestine	ii, 289
LEVENE (P. A.). Chemical Changes in the Developing Egg	ii, 290
JUCKENACK (ADOLF). Composition of Hen's Egg	ii, 290
CAMERER (WILLIAM, JUN.) and FRIEDRICH SÖLDNER. Chemical Composition of New-born Children	ii, 290
OKER-BLOM (MAX.). Chemico-physical Relations of Animal Juices and Tissues	ii, 290
BARBERA (A. G.). Influence of Iodine, Sodium Iodide, and Iodothyron on the Circulation	ii, 291
DAWSON (PERCY M.). Infusion after severe Hæmorrhage	ii, 291
GIES (WILLIAM J.) and LEON ASHER. Influence of Protoplasmic Poisons on Lymph Formation	ii, 291
MOORE (BENJAMIN). Bile as a Solvent	ii, 291
SAOERDOTTI (CESARE). Fat in Cartilage	ii, 291
CHARRIN (ALBERT) and A. GUILLEMONAT. Hepatic Glycogen during Pregnancy	ii, 292
SCHULZ (FRIEDRICH N.). Does Cellulose occur in the Shield of Sepia?	ii, 292
FÜRTH (OTTO VON). The Catechol-like Substance of the Suprarenals	ii, 292
SCHREIBER (E.) and ZAUDY. Deposits of Uric acid artificially produced in Birds	ii, 292
GIES (WILLIAM J.) and A. N. RICHARDS. Coagulable Proteids of Connective Tissues	ii, 292
GIES (WILLIAM J.) and WILLIAM D. CUTTER. Gluco-proteids of White Fibrous Tissue	ii, 293
KELLER (ARTHUR). Organic Phosphorus compounds in Infants' Urine	ii, 293
IMBERT (HENRI) and E. BADEL. Elimination of Sodium Cacodylate in the Urine after administration by the Stomach	ii, 293
COTTON (S.). Oxidation of Urine. Phenols and Indican	ii, 293
GIES (WILLIAM J.) and L. D. MEAD. Physiological Action of Tellurium compounds	ii, 294
OFFER (THEODOR ROB.) and SIGMUND FRÄNKEL. Behaviour of Chitosamine (Glucosamine) Hydrochloride in the Animal Organism	ii, 294
ROSENSTEIN (WLADIMIR). Relationship between the Chemical Constitution of Alkylated Alkaloids and their Physiological Action	ii, 294

	PAGE
MOORE (BENJAMIN) and C. PURINTON. Suprarenal Extracts . . .	ii, 295
HUNT (R.). A Depressor Substance in the Suprarenal Gland . . .	ii, 295
LEVIN (I.). Mucin . . .	ii, 295
MORACZEWSKI (WACŁAW VON). Metabolism in Pernicious Anæmia . . .	ii, 295
MANASSE (PAUL). Multiple Amyloid Tumours in the Upper Air Passages .	ii, 295
MORISHIMA (KURATA). Occurrence of Lactic acid in the Animal Organism in reference to Arsenical Poisoning . . .	ii, 296
MELTZER (S. J.). Toxicology of Potassium Chlorate . . .	ii, 296

Chemistry of Vegetable Physiology and Agriculture.

LINTNER (CARL JOSEPH). Fermentation of Yeast . . .	ii, 296
VITALI (DIOSCORIDE). Formation of Alcohol in the Putrefaction of Pro- teids free from Carbohydrates . . .	ii, 297
HENNEBERG (W.). Acetic Bacteria . . .	ii, 297
BOKORNY (THOMAS). Effect of different substances on the Curdling of Milk	ii, 297
WOLFF (KURT). Denitrification and Fermentation . . .	ii, 298
FRANK (BERNHARD). Inoculation with Nitragin . . .	ii, 298
NOBBE (FRIEDRICH) and LORENZ HILTNER. How can the Action of Nitragin be Increased? . . .	ii, 299
ABEL (RUDOLF) and PAUL BUTTENBERG. Action of Moulds on Arsenic and its compounds. Biological Proof of the Presence of Arsenic . . .	ii, 299
THISELTON-DYER (SIR WILLIAM). Influence of the Temperature of Liquid Hydrogen on the Germinative Power of Seeds . . .	ii, 300
ANDRÉ (GUSTAVE). Changes in the Organic Constituents of the Seed during Germination . . .	ii, 300
MAZÉ (PIERRE). Digestion of the Reserves of Seeds during Germination, and their Assimilation by the Seedlings . . .	ii, 300
BREAL (ÉMILE). Accumulation of Asparagine in Leguminous Plants cultivated with Insufficient Light . . .	ii, 301
BOURQUELOT (ÉMILE) and HENRI HÉRISSEY. Carbohydrates in the Reserve Material of Lucerne and Fenugreek Seeds . . .	ii, 301
LINDET (LÉON). Presence of Dextrose and Lævulose in Beet-leaves . . .	ii, 302
BACHOFEN (F.). Ash of Coccaunt . . .	ii, 302
VANDEVELDE (ALB. J. J.). Plasmolysis. Determination of the Toxicity of Alcohols . . .	ii, 302
TRUE (RODNEY H.). Toxic Action of a series of Acids and their Sodium salts on <i>Lupinus albus</i> . . .	ii, 303
DEHÉRAIN (PIERRE PAUL). Cultivation of Wheat and Oats at Grignon . . .	ii, 303
BRIGHETTI. Experiments on Meadows . . .	ii, 303
MONVOISIN. Vegetation of some Fodder Plants . . .	ii, 303
WERENSKIÖLD (FR.). Analyses of Norwegian Hay . . .	ii, 304
MAXWELL (WALTER). [Experiments on Sugar-cane in Hawaii] . . .	ii, 304
DEHÉRAIN (PIERRE P.) and E. DEMOUSSY. Cultivation of Blue Lupins . . .	ii, 304
SJOLLEMA (B.). Manurial Experiments with Potatoes . . .	ii, 304
SJOLLEMA (B.). Influence of Chlorides and other compounds present in crude Stassfurt salts on the composition and yield of Potatoes . . .	ii, 305
STOKLASA (JULIUS). Injurious Effect of Sodium Nitrate on the growth of Sugar-beet . . .	ii, 305
PAGNOUL (AIME). Effect of Rain and of the nature of the soil on the Pro- duction of Crops . . .	ii, 306
SCHLOESING (TH., jun.). Utilisation by Plants of the Potash dissolved in the Water in Soil . . .	ii, 306
DYMOND (THOMAS) and FRANK HUGHES. Injury to Agricultural Land on the coast of Essex by the Inundation of Sea-water on November 29th, 1897 . . .	ii, 307
BAESSLER (PAUL). Field Experiments with Superphosphate and Basic Slag .	ii, 307
BAESSLER (PAUL). Field Experiments with Potash-lime Manure and Fish Guano	ii, 308
ULRICH (R.). Importance of Poultry Manure . . .	ii, 308

Analytical Chemistry.

	PAGE
DUYK (MAURICE). Perezone, a new Indicator for Alkalimetry	ii, 308
AUCHY (GEORGE). Retention of Water by Asbestos	ii, 309
MOLEND (OSKAR). Estimation of Water in Syrups and similar Products	ii, 309
TRUCHOT (P.). Estimation of Sulphur in Ores, Mattes, &c.	ii, 309
RIEMER (ADOLF). Estimation of Sulphur in Pig- and Cast-iron	ii, 309
HEIDENREICH (OLE N.). Estimation of Sulphur in Pyrites	ii, 310
LANGMUIR (A. C.). Estimation of Sulphur in Bitumens	ii, 310
GRÜTZNER (BRUNO). Estimation of Alkali Persulphates and of Hydrogen Peroxide	ii, 310
VILLIERS (ANTOINE) and E. DUMESNIL. Estimation of Ammonia and of Nitrogen	ii, 310
JOLLES (ADOLF). The Phosphometer, an Apparatus for the Clinical Estimation of Phosphorus in Blood	ii, 311
HANAMANN (JOSEPH). Simplified Method of Estimating Phosphoric Acid by Molybdate	ii, 311
CASALI (ADOLFO). Wagner's new Reagent for Estimating Soluble Phosphoric Acid in Basic Slag	ii, 311
LASNE (HENRI). Detection of Adulterations in Bone Superphosphate	ii, 311
BECK (O. C.) and H. FISHER. Separation and Estimation of Arsenic and Antimony in Ores	ii, 312
STOCK (ALFRED). Volumetric Estimation of Boric acid	ii, 312
BETHIEN (ADOLF) and HANS HEMPEL. Accuracy of Jørgensen's method for Estimating Boric acid in Preserved Meat, and the separation of Boric acid from Borax	ii, 313
TATE (GEORGE). Estimation of Silicon in Ferrochromium and of Silica in Chrome Ore	ii, 313
AUCHY (GEORGE). Estimation of Graphite by Loss	ii, 313
KINNIGUT (LEONARD P.) and GEORGE R. SANDFORD. Iodometric Estimation of small quantities of Carbon Monoxide	ii, 314
VIGNON (LÉO) and LOUIS MRUNIER. Rapid method of Estimating Carbon Dioxide in Gaseous Mixtures	ii, 314
HANDY (JAMES OTIS). Volumetric Estimation of Magnesia	ii, 314
WILLENZ (M.). Estimation of Copper	ii, 315
JANNASCH (PAUL) and K. BIEDERMANN. Precipitation and Separation of Copper in the presence of Sodium Hydroxide by the aid of Hydrazine Sulphate or Hydrochloride	ii, 315
MONTANARI (CARLO). Rapid Estimation of the Purity of Commercial Copper Sulphate, and of the amount of Copper Sulphate in Copper Pyrites	ii, 315
STOCK (ALFRED). Estimation of Aluminium	ii, 315
POQUILLON (F.). Rapid method for the Estimation of Clay in Soils	ii, 316
LANGMUIR (A. C.). Estimation of Nickel in Nickel Ores	ii, 316
IBBOTSON (FRED) and HARRY BREARLEY. Rapid Evaluation of Metallic Tungsten Powders	ii, 316
IBBOTSON (FRED) and HARRY BREARLEY. Analysis of Tungsten compounds	ii, 317
LONGSTAFF (J. P.). Ammonium Molybdate as a Delicate Reagent for Stannous Chloride	ii, 318
SPIEGEL (LEOPOLD). Significance of the Detection of Nitrites in Drinking Water	ii, 318
MILLER (EDMUND H.) and JOHN A. MATHEWS. Cobaltcyanides	ii, 318
RIPPER (MAXIMILIAN). Chemistry and Analysis of Wines	ii, 319
CLAUSER (ROBERT). Estimation of Cresols by determining their Capability of forming Bromo-substitution derivatives	ii, 319
ROSIN (HEINRICH). Estimation of the Reducing Power of Urine, Blood, and other Animal Fluids	ii, 319
MECKE. Detection of Sucrose in Margarine	ii, 319
BODMER (RICHARD), NORMAN LEONARD, and HARRY M. SMITH. Analysis of Golden Syrup	ii, 320

	PAGE
MILLER (ALEXANDER K.) and J. P. POTTS. Analysis of some Sugar Syrups	ii, 320
MAYER (PAUL). Effect of the Presence of Glycuronic acid on the Phenylhydrazine Test for Sugar in Urine	ii, 320
BRUESTEDT (G.). Isolation of Glycogen from Horseflesh and Preserved Meats	ii, 321
HAYWOOD (JOHN K.). Estimation of Glycogen, and relative amounts of Glycogen in different parts of the Flesh of the Horse	ii, 321
DURIEU. Estimation of Acetic Acid in Vinegar	ii, 322
BÜLOW (KARL). Estimation of Oxalic acid in acid Beet Leaves	ii, 322
JOLLES (ADOLF). Action of Iodine Solution and Alkaline Permanganate on Uric acid	ii, 322
GILL (AUGUSTUS H.) and WALTER O. ADAMS. Hübl's Iodine Method for Oil Analysis	ii, 323
LEWKOWITSCHE (JULIUS). Determination of the Iodine Value	ii, 323
LEWKOWITSCHE (JULIUS). Meaning of the Acetyl Value in Fat Analysis	ii, 323
KREIS (HANS) and OTTO WOLF. Rapidity of Saponification of some Fats	ii, 324
GALLIEN (L.). Analysis of Milk	ii, 324
MORINI (UMBERTO). Modification of Duclaux's Method for Estimating Total Solids and Fat in Milk	ii, 324
LEZÉ (R.). Estimation of Fat in Milk	ii, 324
RUFFIN (A.). Changes in the Constants of Butter Fat under the Influence of Feeding	ii, 324
BREMER (HERMANN). Testing Margarine and Butter for Sesamé Oil	ii, 325
SOLTSIEN (PAUL). Testing Margarine and Butter for Sesamé Oil	ii, 325
STRZYZOWSKI (CASIMIR). Halphen's Reaction and its Application to the Estimation of Cotton-seed Oil	ii, 325
BULL (HENRIK). Analysis of Fish Oils (Thranen)	ii, 325
SHUKOFF (AL. A.) and K. T. NOGIN. Analysis of Soap	ii, 326
RICHARDSON (FREDERIC W.) and ADOLF JAFFÉ. Water Softening (or so-called "Scouring") Power of Soaps	ii, 326
VEREIN FÜR CHEMISCHE INDUSTRIE IN MAINZ. Estimation of Formaldehyde	ii, 326
SCHMIDINGER (FRANZ). Estimation of Chloral Alcoholate	ii, 327
HEIM (C.). [Detection of] Furfuraldehyde in Beer	ii, 327
WELMANS (PAUL). Estimation of Vanillin	ii, 327
HAFNER (B.). Estimation of Glycyrrhizin in Liquorice Extract	ii, 328
STRUVE (HEINRICH). The Florence Reaction	ii, 328

INDEX OF AUTHORS' NAMES.

A.

Abderhalden, E., ii, 289.
 Abegg, R., ii, 253.
 Abegg, R., and C. Immerwahr,
 ii, 256.
 Abel, R., and P. Buttenberg, ii, 299.
 Adams, W. O. See A. H. Gill.
 Albert, R., and E. Buchner, i, 320.
 André, G., ii, 300.
 Ansel, O. See H. von Pechmann.
 Arnold, V., i, 318.
 Asher, L. See W. J. Gies.
 Aston, E. See P. A. Guye.
 Aston, W. G. See J. T. Hewitt.
 Athanasian, J., ii, 288.
 Atwater, D. See H. L. Wheeler.
 Atwater, W. O., ii, 288.
 Auchy, G., ii, 309, 313.
 Auwers, K., W. Bartsch, F. H.
 Betteridge, M. Dohrn, and H. M.
 Smith, ii, 262.

B.

Bachofen, F., ii, 302.
 Badel, E. See H. Imbert.
 Baessler, P., ii, 307, 308.
 Baker, H. B., *TRANS.*, 646.
 Baker, J. L., and T. H. Pope,
TRANS., 696.
 Bamberger, E., and G. Djerdjian,
 i, 309.
 Bamberger, E., and A. Hill, i, 281.
 Barbéra, A. G., ii, 291.
 Barnes, B. See H. L. Wheeler.
 Barnes, H. T., ii, 254.
 Bartsch, W. See K. Auwers.
 Bauer, W. See H. von Pechmann.
 Beck, O. C., and H. Fisher, ii, 312.
 Behn, U., ii, 259, 260.
 Behrend, R., and F. C. Meyer, i, 287.
 Berthelot, M., ii, 261.
 Betteridge, F. H. See K. Auwers.
 Betti, M. See H. Schiff.

Beythien, A., and H. Hempel,
 ii, 313.
 Biedermann, K. See P. Jannasch.
 Bistrzycki, A., i, 315.
 Bloch, M., and S. von Kostanecki,
 i, 308.
 Bodmer, R., N. Leonard, and H. M.
 Smith, ii, 320.
 Bohr, C., ii, 267.
 Bokorny, T., ii, 297.
 Bone, W. A., and C. H. G. Sprankling,
TRANS., 654.
 Boorsma, S. E., i, 304.
 Bougault, J., i, 311, 312.
 Bourquelot, E., and H. Hérissé, y,
 i, 320; ii, 301.
 Braren, W., and E. Buchner,
 i, 292.
 Bréal, E., ii, 301.
 Brearley, H. See F. Ibbotson.
 Bredig, G., ii, 278.
 Bredig, G., and A. Coehn, ii, 269.
 Bremer, H., ii, 325.
 Breustedt, G., ii, 321.
 Brieger, L., i, 316.
 Brighetti, ii, 303.
 Brochet, A., ii, 276.
 Bruner, L., ii, 268.
 Bruni, G., ii, 269.
 Brunnmayr, H., i, 291.
 Bruyn, B. R. de, ii, 266.
 Bryant, E. G., ii, 277.
 Buchner, E. See R. Albert, W.
 Braren.
 Bülow, K., ii, 322.
 Bull, H., ii, 325.
 Busch, M., and C. Heinrichs, i, 314.
 Buttenberg, P. See R. Abel.
 Butureanu, V. C., ii, 285.

C.

Camerer, W., jun., and F. Söldner,
 ii, 290.
 Camps, R., i, 310.

Casal, A., ii, 311.
 Chambers, V. J. See H. C. Jones.
 Charabot, E., i, 303.
 Charrin, A., and A. Guillemonat, ii, 292.
 Chiaraviglio, D. See J. H. van't Hoff.
 Chikashigé, M. See M. Kuhara.
 Clauser, R., ii, 319.
 Coshn, A. See G. Bredig.
 Coen, E., i, 307.
 Cohnheim, O., ii, 289.
 Collins, E. See T. W. Richards.
 Cooper, H. C., ii, 269.
 Cotton, S., ii, 293.
 Crépieux, P. See F. Reverdin.
 Crotogino, F. See F. W. Kuster.
 Curie, P., and S. Curie, ii, 254.
 Cutter, W. D. See W. J. Gies.

D.

Dawson, P. M., ii, 291.
 Dehérain, P. P., ii, 303.
 Dehérain, P. P., and E. Demoussy, ii, 304.
 Delange, R., i, 289.
 Demoussy, E. See P. P. Dehérain.
 Denigès, G., i, 274.
 Derrien, E., i, 299.
 Desborough, A. P. H. See W. R. E. Hodgkinson.
 Dieckmann, W., i, 297.
 Dieckmann, W., and A. Groneveld, i, 297.
 Divers, E., and T. Haga, TRANS., 673.
 Djierdjian, G. See E. Bamberger.
 Doebner, O., i, 313.
 Doherty, W. M., ii, 283.
 Dohrn, M. See K. Auwers.
 Drossbach, G. P., ii, 270.
 Duden, P., i, 282; ii, 267.
 Duden, P., and A. E. MacIntyre, i, 302.
 Dumesnil, E. See A. Villiers.
 Durieu, ii, 322.
 Duyk, M., ii, 308.
 Dymond, T., and F. Hughes, ii, 307.

E.

Edgerly, D. W. See J. F. Norris.
 Eichwede, H. See J. Thiele.
 Eltchaninoff, E. See P. I. Petrenko-Kritschenko.
 Enzensauer, J. See F. Richter.
 Etard, A., i, 301.
 Euler, H., ii, 269.
 Eustis, A. C., i, 317.
 Evans, T., i, 309.

F.

Fay, H. See J. F. Norris.
 Fink, I. See J. Klaudy.
 Fisher, H. See O. C. Beck.
 Flemming, H., i, 280.
 Forcrand, R. de, ii, 277.
 Fosse, R., i, 298.
 Fränkel, S. See T. R. Offer.
 François, M., ii, 280.
 Frank, B., ii, 298.
 Fraps, G. S., ii, 276.
 Fürth, O. von, ii, 292.

G.

Gabounia, A. See E. Tistschenkow.
 Gach, F., i, 276.
 Gallein, L., ii, 324.
 Gautier, A., ii, 258.
 Geitel, A. C., and G. van der Want, i, 271.
 Gies, W. J., i, 317.
 Gies, W. J., and L. Asher, ii, 291.
 Gies, W. J., and W. D. Cutter, ii, 293.
 Gies, W. J., and L. D. Mead, ii, 294.
 Gies, W. J., and A. N. Richards, ii, 292.
 Gill, A. H., and W. O. Adams, ii, 323.
 Goldschmidt, C., i, 285.
 Graebe, C., i, 296.
 Grey, C. See A. Liversidge.
 Groneveld, A. See W. Dieckmann.
 Grütznér, B., ii, 310.
 Guillemonat, A. See A. Charrin.
 Guldberg, C. M., ii, 264.
 Guye, P. A., and E. Aston, ii, 253.

H.

Haasy, von. See W. Hempel.
 Haber, F., i, 281; ii, 257.
 Haber, F., and C. Schmidt, i, 282.
 Hafner, B., ii, 328.
 Haga, T. See E. Divers.
 Haldane, J. S., i, 318.
 Haller, A., i, 301.
 Hanamann, J., ii, 311.
 Handy, J. O., ii, 314.
 Hantzsch, A., ii, 274.
 Hantzsch, A., and J. S. Smythe, i, 315.
 Hauser, O. See L. Vanino.
 Hausmann, W., i, 317.
 Haywood, J. K., ii, 321.
 Heidenreich, O. N., ii, 310.
 Heim, C., ii, 327.
 Heimrod, G. W. See T. W. Richards.
 Heinrichs, C. See M. Busch.

Hempel, H. See A. Beythien.
 Hempel, W., and von Haasy, ii, 275.
 Henneberg, W., ii, 297.
 Hérissé, H. See R. Bourquelot.
 Hewitt, J. T., and W. G. Aston,
 TRANS., 712.
 Higbee, H. H., i, 285.
 Higgin, A. J., ii, 283.
 Hill, A. See E. Bamberger.
 Hillyer, H. W., i, 289.
 Hiltner, L. See F. Nobbe.
 Hodgkinson, W. R. E., R. Waring,
 and A. P. H. Desborough, ii, 282.
 Hoehnel, M., i, 279.
 Hofer, H., i, 275.
 Hoff, J. H. van't, and D. Chiara-
 viglio, ii, 284.
 Hoff, J. H. van't, and N. Kassatkin,
 ii, 284.
 Hofmann, K. A., and E. C. Marburg,
 ii, 279.
 Hollis, F. S., i, 292.
 Hoyer, E. See C. Liebermann.
 Hughes, F. See T. Dymond.
 Hugot, C., ii, 274.
 Hunt, R., ii, 295.

I.

Ibbotson, F., and H. Brearley,
 ii, 316, 317.
 Imbert, H., and E. Badel, ii, 293.
 Immerwahr, C. See R. Abegg.
 Itzig, H. See A. Rosenheim.
 Iwaski, C., ii, 286.

J.

Jackson, H. C. See L. B. Mendel.
 Jacobson, H., and A. Loeb, i, 281.
 Jaffé, A. See F. W. Richardson.
 Jannasch, P., and K. Biederman,
 ii, 315.
 Japp, F. R., and J. Moir, TRANS.,
 608.
 Jaubert, G. F., i, 296, 315.
 Jesser, L., i, 276.
 Johnson, T. B. See H. L. Wheeler.
 Jolles, A., ii, 311, 322.
 Jones, H. C., and V. J. Chambers,
 ii, 282.
 Jones, W., i, 319.
 Jowett, H. A. D., TRANS., 707.
 Juckenack, A., ii, 290.

K.

Kahlbaum, G. W. A., ii, 277.
 Kahlenberg, L., ii, 270.

Kassatkin, N. See J. H. van't Hoff.
 Keller, A., ii, 293.
 Kemp, J. F., ii, 283.
 Kijner, N. M., i, 277.
 Kinnicut, L. P., and G. R. Sanford,
 ii, 314.
 Kisseleff, M. G. See E. Tistachen-
 kow.
 Klaudy, J., and I. Fink, i, 284.
 Königsberger, J., ii, 258.
 Kohn, L., i, 274.
 Konowaloff, D. P., ii, 265.
 Kostanecki, S. von. See M. Bloch.
 Kowalewsky, W. von, ii, 256.
 Kreis, H., and O. Wolf, ii, 324.
 Krügel, C. See A. Ladenburg.
 Küster, F. W., and F. Crotogine,
 ii, 255.
 Küster, F. W., and A. Thiel, ii, 255.
 Küster, W., i, 319.
 Kuhara, M., and M. Chikashigá,
 ii, 280.
 Kurnakoff, N. S., ii, 277.

L.

Ladenburg, A., and C. Krügel,
 ii, 258.
 Langmuir, A. C., ii, 310, 316.
 Larsen, A., ii, 255.
 Lasne, H., ii, 311.
 Leathers, J. P., i, 318.
 Lebeau, P., ii, 276.
 Lenher, V., and J. L. R. Morgan,
 ii, 273.
 Leonard, N. See R. Bodmer.
 Leroy, E., ii, 261.
 Lessing, R. See R. Willstätter.
 Levene, P. A., i, 317; ii, 290.
 Levene, P. A., and L. B. Mendel,
 i, 318.
 Levin, I., ii, 295.
 Lewin, L. See G. Schweinfurth.
 Lewis, G. N., ii, 264.
 Lewkowitsch, J., ii, 323.
 Lézé, R., ii, 324.
 Liebermann, C., and E. Hoyer,
 i, 310.
 Lieck, H. See H. Pauly.
 Linck, G. E., ii, 286.
 Lindauer, G., i, 306.
 Lindet, L., ii, 302.
 Linebarger, C. E., ii, 273.
 Lintner, C. J., ii, 296.
 Liversidge, A., W. Skey, and G.
 Grey, ii, 288.
 Loeb, A. See H. Jacobson.
 Longstaff, J. P., ii, 318.
 Luther, E., ii, 253.

M.

- Macintyre, A. E. See P. Duden.
 Manasse, E., ii, 287.
 Manasse, P., ii, 295.
 Manchot, W., i, 300.
 Marazoueff, N. See E. Tistschen-
 kow.
 Marburg, E. C. See K. A. Hofmann.
 Maronneau, G., ii, 281.
 Marshall, H., ii, 277.
 Marsichi, G. See H. Schiff.
 Massol, G., ii, 260.
 Mathews, J. A. See E. H. Miller.
 Maxwell, W., ii, 304.
 Mayer, P., ii, 320.
 Mazé, P., ii, 300.
 Mead, L. D. See W. J. Gies.
 Mecke, ii, 319.
 Meisenheimer, J. See J. Thiele.
 Meltzer, S. J., ii, 296.
 Mendel, L. B., and H. C. Jackson,
 ii, 288.
 Mendel, L. B. See also P. A. Levene.
 Menne, E., i, 286.
 Merz, V., and H. Strasser, i, 289,
 313, 314.
 Meunier, L., and A. Rigot, i, 316.
 Meunier, L. See also L. Vignon.
 Meyer, F. C. See R. Behrend.
 Meyer, K., ii, 263.
 Miller, A. K., and J. P. Potts, ii, 320.
 Miller, E. H., and J. A. Mathews,
 ii, 318.
 Minguin, J., i, 301.
 Minunni, G., and G. Ortoleva,
 i, 309.
 Moir, J. See F. R. Japp.
 Moissan, H., ii, 271, 280.
 Molenda, O., ii, 309.
 Montanari, C., ii, 315.
 Monvoisin, ii, 303.
 Moore, B., ii, 291.
 Moore, B., and G. Purinton, ii, 295.
 Moraczewski, V. von, ii, 295.
 Morgan, J. L. R., ii, 255.
 Morgan, J. L. R. See also V. Lenher.
 Morini, U., ii, 324.
 Morishima, K., ii, 296.
 Morton, D. A. See W. R. Orndorff.
 Müller, P., ii, 289.

N.

- Nagel, I., i, 271.
 Neumann, A., i, 319.
 Nobbe, F., and L. Hiltner, ii, 299.
 Nogin, K. T. See A. A. Shukoff.
 Norris, J. F., and H. Fay, ii, 272.
 Norris, J. F., H. Fay, and D. W.
 Edgerly, ii, 272.

O.

- Obermiller, J. See H. von Pech-
 mann.
 Oesterle, O. A., i, 304.
 Offer, T. R., and S. Fränkel, ii, 294.
 Oker-Blom, M., ii, 290.
 Orndorff, W. R., and D. A. Morton,
 i, 289.
 Ortoleva, G. See G. Minunni.
 O'Sullivan, J., TRANS., 691.

P.

- Pagnoul, A., ii, 306.
 Pauly, H., and H. Lieck, i, 274.
 Pease, H. C., ii, 257.
 Pechmann, H. von, i, 313.
 Pechmann, H. von, and O. Ansel,
 i, 287.
 Pechmann, H. von, and W. Bauer,
 i, 314.
 Pechmann, H. von, and J. Ober-
 miller, i, 294.
 Pélabon, H., ii, 265.
 Petrenko-Kritschenko, P. I., i, 306.
 Petrenko-Kritschenko, P. I., and
 E. Eltchaninoff, i, 307.
 Plavec, M., ii, 288.
 Poda, H., and W. Prausnitz, ii, 289.
 Pollak, J. See H. Weidel.
 Pollok, J. H., ii, 287.
 Pope, T. H. See J. L. Baker.
 Poquillon, P., ii, 316.
 Potts, J. P. See A. K. Miller.
 Prausnitz, W. See H. Poda.
 Preston, H. L., ii, 287.
 Purinton, G. See B. Moore.
 Pushin, N. N. See E. Tistschenkow.

R.

- Reverdin, F., and P. Crépieux,
 i, 288.
 Reychler, A., ii, 258.
 Richards, A. N. See W. J. Gies.
 Richards, T. W., E. Collins, and
 G. W. Heimrod, ii, 256.
 Richardson, F. W., and A. Jaffé,
 ii, 326.
 Richter, F., J. Enzenauer, and E.
 Uellenberg, i, 312.
 Riemer, A., ii, 309.
 Rigot, A. See L. Meunier.
 Ripper, M., ii, 319.
 Röhmann, F., ii, 289.
 Roscoe, Sir H. E., TRANS., 513.
 Rosenheim, A., and H. Itzig, i, 272 ;
 ii, 282.

Rosenheim, O., and P. Schidrowitz, ii, 289.
 Rosenstein, W., ii, 294.
 Rosin, H., ii, 319.
 Ruffin, A., ii, 324.

S.

Sacerdotti, C., ii, 291.
 Saligny, A. C., ii, 282.
 Salzer, T., ii, 260, 270.
 Sandelin, S. S., i, 305, 306.
 Sanford, G. R. See L. P. Kinnicut.
 Schall, C., ii, 271.
 Scheye, A., ii, 254.
 Schidrowitz, P. See O. Rosenheim.
 Schiff, H., M. Betti, and G. Marzichi, i, 279.
 Schilling, R. von. See D. Vorländer.
 Schimansky, S., i, 305.
 Schloesing, T., jun., ii, 306.
 Schlösser, P. See C. Willgerodt.
 Schmidinger, F., ii, 327.
 Schmidt, C. See F. Haber.
 Schmidt, J., i, 299.
 Schreiber, E., and Zaudy, ii, 292.
 Schümann, M., ii, 264.
 Schulz, F. N., ii, 292.
 Schumann, H., ii, 271.
 Schuyten, M. C., ii, 279.
 Schweinfurth, G., and L. Lewin, ii, 283.
 Schweitzer, R., i, 277.
 Scott, A., TRANS., 648, 651.
 Seton, A. M., and K. L. Stevenson, ii, 276.
 Severin, E., i, 296.
 Shukoff, A. A., and K. T. Nogin, ii, 326.
 Sjollema, B., ii, 304, 305.
 Skey, W. See A. Liversidge.
 Smith, H. M. See K. Auwers, R. Bodmer.
 Smythe, J. S. See A. Hantzsch.
 Söldner, F. See W. Camerer, jun.
 Soltsien, P., ii, 325.
 Spiegel, L., ii, 318.
 Sprankling, C. H. G. See W. A. Bone.
 Stevenson, K. L. See A. M. Seton.
 Stock, A., ii, 312, 315.
 Stocklass, J., ii, 305.
 Stolle, F., i, 277.
 Strasser, H. See V. Merz.
 Struve, H., ii, 328.
 Strzyzowski, C., ii, 325.
 Szarvasy, E. C., TRANS., 603.

T.

Tate, G., ii, 318.
 Thiel, A., ii, 260.

Thiel, A. See also F. W. Küster.
 Thiele, J., i, 298.
 Thiele, J., and H. Eichwede, i, 288.
 Thiele, J., and J. Meisenheimer, i, 299.
 Thielton-Dyer, Sir W., ii, 300.
 Thorpe, T. E., TRANS., 555.
 Thudichum, J. L. W., i, 319.
 Tiemann, F., i, 275.
 Tingle, J. B., and A. Tingle, i, 302.
 Tistschenkow, E., with A. Gabounia, M. G. Kisseleff, N. Marazoueff, and N. N. Puschin, i, 269.
 Truchot, P., ii, 309.
 True, R. H., ii, 308.
 Twitchell, E., i, 296.

U.

Uellenberg, E. See F. Richter.
 Ulrich, R., ii, 308.

V.

Vandevelde, A. J. J., i, 272; ii, 302.
 Vanino, L., and O. Hauser, ii, 279.
 Vaubel, W., ii, 264, 274.
 Vignon, L., and L. Meunier, ii, 314.
 Villiers, A., and E. Dumesnil, ii, 310.
 Vitali, D., ii, 297.
 Vorländer, D., and R. von Schilling, i, 295.
 Vorländer, D., and H. Weissbrenner, i, 295.

W.

Walker, J., ii, 268.
 Want, G. van der. See A. C. Geitel.
 Waring, R. See W. R. E. Hodgkinson.
 Wedell-Wedellsborg, P. S., ii, 254.
 Weibull, M., ii, 286, 287.
 Weidel, H., and J. Pollak, i, 290, 291.
 Weidel, H., and F. Wenzel, i, 308.
 Weiler, M., i, 283.
 Weissbrenner, H. See D. Vorländer.
 Weissweiler, G., i, 291.
 Welman, P., ii, 327.
 Wenzel, F. See H. Weidel.
 Werenskiöld, F., ii, 304.
 West, C. A., TRANS., 705.
 Wheeler, H. L., D. Atwater, T. B. Johnson, and B. Barnes, i, 293.
 Wikander, H., i, 310.
 Wildermann, M., ii, 262.

- | | |
|-----------------------------------|------------------------|
| Willenz, M., ii, 315. | Wolf, O. See H. Kreis. |
| Willgerodt, C., and P. Schlösser, | Wolff, K., ii, 298. |
| i, 282. | |
| Willstätter, R., and R. Lessing, | |
| i, 304. | |
| Wilson, H. A., ii, 285. | |
| Wobbe, W., ii, 281. | |
| Wolf, C. G. L., i, 274. | |

Z.

Zaudy. See E. Schreiber.

ERRATA.

VOL. LXXXVI. (ABSTR., 1899).

PART I.

Page	Line	
798	3*	for "Phenylfurfurylamine" read "Phenylfurfurylcarbinyllamine."

PART II.

8	18*	„ "saumontite" read "laumontite."
545	{ 9 14 }	„ "nitrogen" read "nitric oxide."

VOL. LXXXVII. (TRANS., 1900).

437	22	„ "1870" read "1871."
444	9*	
446	4 }	„ "nitrite" read "nitrogen."

* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
LXII.—Decomposition of Chlorates. Part II. Lead Chlorate. By WILLIAM H. SODEAU, B.Sc.	717
LXIII.—Action of Iodine on Alkalis. By ROBERT LLEWELLYN TAYLOR	725
LXIV.—Alkylation by means of Dry Silver Oxide and Alkyl Halides. By GEORGE DRUCE LANDER, D.Sc.	729
LXV.—Hydrosulphides, Sulphides, and Polysulphides of Potassium and Sodium. By W. POPPLEWELL BLOXAM, B.Sc. . . .	753

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

MICHAEL (ARTHUR). Certain Laws and their Application in Organic Chemistry	i, 321
WOLKOFF (ALESEI A.) and BORIS N. MENSCHUTKIN. Preparation of Saturated Hydrocarbons	i, 321
BRUSSOFF (S.). Velocity of Formation of Olefines	i, 322
MATHEWS (JOHN ALEXANDER). Laboratory Method for the Continuous and Uniform Generation of Acetylene	i, 323
MATHEWS (JOHN A.) and L. L. WATTERS. Gold Carbide	i, 323
LEFEBVRE (P.). Action of Amyl Chloride on Calcium Carbide	i, 323
KONOWALOFF (MICHAEL I.) and W. PLOTNIKOFF. Compounds of Aluminium Haloid Salts with Organic and Inorganic Substances. II.	i, 323

	PAGE
BERTHELOT (MARCELLIN) and MARCEL DELÉPINE. Iodide of Cuprous Acetylides	i, 324
KONOWALOFF (MICHAEL I.) [with A. JEBENKO and S. KOTSINA]. Nitration of Menthane and of Triethylmethane	i, 324
KONOWALOFF (MICHAEL I.). Salts of Nitro-compounds with Nitrated Bases. Separation of Nitro-compounds of different Types	i, 324
MAXIMOVITSCH (STEPHAN). Quinquevalent Alcohol from Methylallyl-carbinol	i, 325
STRÖMHOLM (DANIEL). Sulphine and Thetine derivatives	i, 325
VANZETTI (L.). Attempts to obtain Optical Antipodes of Quadrivalent Sulphur derivatives	i, 327
COJAZZI (F.). Energy of some Hydroxy-sulphonic acids	i, 327
ZERNOFF (W.). Iodation of Fatty acids	i, 327
POKRÓVSKY (ARISTARCH). β -Methylethylhydracrylic acid and β -Methylethylacrylic acid	i, 328
TALANZEFF (ZINOVY). β -Methyltertbutylhydracrylic acid	i, 328
BAEYER (ADOLF VON) and VICTOR VILLIGER. Action of Caro's Reagent on Ketones	i, 328
BLANC (G.). Constitution of <i>iso</i> -Lauronic acid	i, 329
BLAISE (EDMOND E.). β -Hydroxy- $\alpha\alpha\beta$ -trimethyladipic acid	i, 329
BULLNHEIMER (FRIEDRICH) and E. SEITZ. Alkali Copper Tartrates and Fehling's Solution. II.	i, 330
TIEMANN ([JOHANN CARL WILHELM] FERDINAND) [with MAX KERSCHEBAUM]. Stereoisomeric forms of Citral	i, 331
HARRIES (CARL D.). Citronellalacetal	i, 331
PERRIER (GUSTAVE). Function of Aluminium Chloride in the Friedel-Craft's Reaction	i, 331
SCHMIDT (JULIUS). Electrolytic Oxidation of Ketoximes. New Method of preparing Aliphatic Nitroso-compounds	i, 332
VOTOČEK (EMIL). Rhodose, a new Sugar of the Methylpentose Series	i, 332
BRUYN (C. A. LOBBY DE) and WILLIAM ALBERDA VAN EKENSTEIN. <i>d</i> -Sorbosose and <i>l</i> -Sorbosose (ψ -Tagatose) and their Configuration	i, 332
PONSOT (A.). Cryoscopy of Tanret's Rhamninose and Rhamninotronic Acid	i, 333
STOLLE (F.). Solubility of Salts of Calcium, Iron, and Copper in Sucrose solutions	i, 333
KIJNER (NIC. M.). Action of Silver Oxide, and of Hydroxylamine, on Bromo-amines	i, 333
MUSSELIUS (L.). Acetylation of Primary and Secondary Amines	i, 334
MENSCHUTKIN (NICOLAI A.). Reaction for distinguishing differently substituted Amines	i, 335
MENSCHUTKIN (NICOLAI A.). Influence of the Side Chain on the properties of Open and Closed Chain compounds. V. Velocity of combination of Secondary Amines with Alkyl Bromides	i, 335
ESCH (WERNER) and WILHELM MARCKWALD. Ethylenetrimethylenediamine and Methylpiperazine	i, 336
MARCKWALD (WILHELM). Dimethylenimine	i, 336
KUDERNATSCHE (RICHARD). Hexethylidenetetramine	i, 337
MENSCHUTKIN (NICOLAI A.). Structure of Acid Amides	i, 337
SCHOLL (ROLAND) and WILHELM NÖRR. Action of Chlorine Monoxide on Benzene	i, 337
FELS (G.). Isomorphous Replacement of Halogens and Hydroxyl	i, 338
WILLGERODT (CONRAD) and VINCENT ALLEN HOWELLS. <i>as</i> -Iodoso-, iodoxy-, and iodonium-compounds derived from <i>m</i> -Xylene	i, 338
WILLGERODT (CONRAD). Preparation of Iodoso- and Iodoxy-compounds	i, 339
ALLEN (RICHARD WILLIAM). Naphthalene Vapour in Coal Gas	i, 339
CHILKOTTI (ALBERTO). Refraction of Hydrocarbons with Condensed Benzene Nuclei	i, 339
BÉNECH (ÉLOPHE). Action of Phenylcarbimide and Phenylthiocarbimide on Dibasic acids	i, 340
STIEGLITZ (JULIUS) and RALPH H. MCKEE. Oxygen Ethers of Carbamides. Methylisocarbamide	i, 340

	PAGE
MENSCHUTKIN (NICOLAI A.). Influence of the Side Chain on the properties of Open and Closed Chain Carbon compounds. VI. Influence of chemically indifferent Solvents on the distribution of the velocity of reaction in Isomeric Benzene derivatives	i, 341
BAMBERGER (EUGEN) [and in part MARIE BAUM, L'ORSA, ARMAND STIEGELMANN, and FRED. TSCHIRNER]. Action of Formaldehyde on β -Aromatic Hydroxylamines	i, 341
BAMBERGER (EUGEN) and FRED. TSCHIRNER. Action of Diazomethane on β -Aromatic Hydroxylamines	i, 342
BREUKELVEEN (M. VAN). Crystalline compounds of Succinimide and the Phenols	i, 343
KÖTZ (ARTHUR) [with SEVIN]. Xylylene Hydrosulphides	i, 343
GEORGESCU (M.). Aromatic Esters of Sulphurous acid	i, 343
MOSCHNER (J.). Hydrindene, and a new Hydroxyhydrindene	i, 344
WOLF (C. G. L.). Melting Point of Ethyl Formylphenylacetate	i, 345
BISOHOFF (CARL ADAM). Formation of Chains. XLII. Phenoxypropionic acids and their derivatives	i, 345
BISOHOFF (CARL ADAM). Formation of Chains. XLIII. α -Phenoxybutyric, α -isobutyric, and α -isovaleric acids and their Esters	i, 345
KLEY (P.). Crystalline Formation of Indigotin	i, 346
WISLICENUS (WILHELM). Ethyl Fluoreneoxalate and Indeneoxalate	i, 346
THEILE (JOHANNES). Condensation Products of Indene and Fluorene	i, 347
HENZE (MARTIN). Condensation of Benzyl Cyanide and Ethyl Fumarate	i, 347
WIDMAN (OSKAR). Usnic acid	i, 347
STEFANI (PIO DE). Attempts to obtain active Isomerides of Hexahydro- and α -Hexahydro-mellitic acids	i, 349
BOESSEN (J.). Friedel and Craft's Reaction	i, 349
NEF (JOHN ULRIC). Alkylation of Ketones	i, 349
PETRENKO-KRITSCHENKO (PAVEL IW.) and P. KARANIEZKY. Ketoximes	i, 350
PERRIER (GUSTAVE). Anthraphenones	i, 350
COHN (PAUL). Action of Menthol on Ethyl Acetoacetate	i, 350
COHN (PAUL) and SIEGFRIED TAUSS. Menthyl Acetoacetate	i, 350
SEMMLER (FRIEDRICH WILHELM). Borneol and Isoborneol	i, 351
GENVRESSE (P.). New Terpenoid alcohol and its derivatives	i, 351
TSCHUGAEFF (L.). Conversion of Carvone into Limonene	i, 352
KONOWALOFF (MICHAEL I.). Preparation of Camphene and Menthene from the corresponding alcohols	i, 352
PERRIER (GUSTAVE). Essence of Chrysanthemum	i, 352
KERSCHBAUM (MAX). The Aldehydic constituents of Oil of <i>Verbena</i> . Verbenone	i, 353
WEBER (CARL OTTO). India-rubber	i, 353
VITOČEK (EMIL). Sugars of some Glucosides	i, 353
LIEBERMANN (CARL [THEODOR]). Compounds from Rhubarb and allied substances	i, 355
KOSTANECKI (STANISLAUS VON) and W. FEUERSTEIN. Brazilin	i, 355
GADAMER (JOHANNES). Alkaloids of the <i>Solanaceae</i>	i, 355
SEYEWETZ (ALPHONSE). Combination of Basic with Acidic Colouring Matters	i, 356
BOCCHI (O.). Action of Bromoform and Chloroform on some Pyrroles	i, 357
PAULY (HERMANN) and CARL BOEHM. Action of Amines on Dibromotriacetanamine	i, 357
GABRIEL (SIEGMUND) and JAMES COLMAN. Action of the Sodium Alkyl-oxides on Ethyl Phthalylaminoacetate and its Homologues	i, 358
GABRIEL (SIEGMUND) and JAMES COLMAN. 4-Hydroxyisocarbostyryl	i, 359
BRUNNER (KARL). Synthesis of Indoline Bases	i, 360
ULLMANN (FRITZ) and E. NAEF. Syntheses in the Acridine Series. I. 2'-Methyl-1:2-naphthacridine	i, 360
ULLMANN (FRITZ) and E. NAEF. Syntheses in the Acridine Series. II. 3'-Amino-2'-methyl-1:2-naphthacridine	i, 361
BOTGAULT (J.). Compounds of Iodoantipyrine with Mercuric salts	i, 361

	PAGE
VILLE (JULES) and CHARLES ASTRE. New compounds of Mercuric Chloride and Antipyrine	i, 362
SACHS (FRANZ). Condensation of Aromatic Nitroso-compounds with Methylene derivatives	i, 362
CENSI (J.). Action of Methyl Chloroacetate on Tertiary Bases	i, 363
WEDEL (JEAN). Interaction of Hydrazine Hydrate with certain Lactones	i, 363
TAMBORE (JOSEF [with ERNST and LIOŃSKI]). Indogenides of the Pyrazole Series	i, 364
HÄUSSERMAN (CARL). Tertiary Aromatic Amines. III.	i, 365
HANTZSCH (ARTHUR [RUDOLF]). Salts and Bases of Triphenylmethane Dyes	i, 365
FICHTER (FRITZ) and EMANUEL SCHIESS. Colouring Matters of the Form-azyl Group	i, 366
BEUTEL (ERNST). Tolyldiguanides and Benzylidiguanides	i, 367
MÖHLAU (RICHARD) and W. SCHAPOSHNIKOFF. Action of Tetramethyldiaminobenzhydrol on Rosinduline and Isorosinduline	i, 367
GOLDSCHMIDT (HEINRICH) and GUSTAV KEPPELER. Dynamical Researches on the Formation of Azo-dyes. IV.	
MÖHLAU (RICHARD) and ERICH STROHBACH. Abel's Dibenzeneazo- β -dinaphtholmethane and Dinitroso- β -dinaphtholmethane	i, 368
ABEL (JOHN J.). Phenylcarbamie Ester of Epinephrine	i, 368
PARTHEIL (ALFRED) and A. GRONOVER. Action of Triethylphosphine on <i>ortho</i> -Dibromo- <i>o</i> -xylene	i, 368

PART II.

General and Physical Chemistry.

BERTHELOT (MARCELLIN PIERRE EUGENE). Chemical Action of Light contrasted with that of the Silent Discharge	ii, 329
SIERTSEMA (L. H.). Influence of Pressure on the rotation of Sucrose	ii, 329
EDER (JOSEF M.) and EDUARD VALENTA. Spectrum of Bromine	ii, 330
BARY (PAUL). Fluorescence of Metallic compounds under the Influence of the Röntgen Rays and Becquerel Rays	ii, 330
SMITH (S. W. J.). Nature of Electrocapillary Phenomena. I. Their relation to the Potential Differences between Solutions	ii, 330
TOWER (OLIN FREEMAN). Potential Differences with Manganese Dioxide Electrodes	ii, 331
CALVERT (HARRY THORNTON). Dielectric Constant of Hydrogen Peroxide	ii, 331
OKER-BLOM (MAX). Effect of Suspended Particles on Conductivity	ii, 331
MASSOULIER (P.). Electrolytic Conductivity and Internal Friction in Saline Solutions	ii, 331
ŠULC (OTTO KAR). Conductivity of some Sodium derivatives of Nitro-paraffins	ii, 332
MACGREGOR (JAMES G.). Finding the Ionisation of Complex Solutions of given Concentration, and the Converse Problem	ii, 332
BARNES (JAMES). Conductivity, Specific Gravity, and Surface Tension of Aqueous Solutions containing Potassium Chloride and Sulphate	ii, 332
GOCKEL (ALBERT). Electrolytic Decomposition Point of Aqueous Solutions	ii, 332
LORENZ (RICHARD) [with A. HELFENSTEIN]. Electrolysis of Fused salts	ii, 333
DU BOIS (H.) and OTTO LIEBKNECHT. Molecular Susceptibility of the salts of the Rare Earths	ii, 333

	PAGE
LEES (CHARLES H.). Thermal Conductivities of Mixtures and of their Constituents	ii, 333
MELLOR (J. W.). Bunsen's Ice Calorimeter	ii, 334
BERTHELOT (MARCELLIN) and MARCEL DELÉPINE. Heat of Combustion of very Volatile Liquids	ii, 334
LUGININ (WLADIMIR F.). Heat of Vaporisation of Nitriles and other Organic compounds	ii, 334
LOOMIS (ELMER HOWARD). Freezing Point of Aqueous Solutions of Non-electrolytes	ii, 335
EMERY (J. A.) and FRANK K. CAMERON. Freezing Point Curves for Water containing Hydrogen Chloride and Phenol	ii, 335
BERTHELOT (DANIEL). Minimum Volume of Liquids	ii, 335
VANDENBERGHE (AD.). Dissociation of Dissolved Substances. I.	ii, 335
HOSKING (R.). Viscosity of Solutions	ii, 336
ROSSET (G.). Drop Methods for the Determination of Molecular Weights	ii, 336
BERTHELOT (DANIEL). Molecular Association in Liquids	ii, 337
PONSOT (A.). Chemical Reactions in Solution: Vapour Tension of the Solvent	ii, 337
HERZ (W.). Equilibrium in the Partition of an Acid between Zinc Hydroxide and Ammonia	ii, 337
LÖWENHERZ (RICHARD). Decomposition by Sodium of Organic Halogen compounds dissolved in Amyl alcohol	ii, 338
BEEMELÉN (JACOBUS M. VAN) and EDUARD A. KLOBBE. Absorption of Hydrogen Chloride and Potassium Chloride from Aqueous Solution by Colloidal Stannic Oxide	ii, 338
DUHEM (PIERRE). Emission and Absorption of Water Vapour by Colloidal matter	ii, 338
TOMMASI (DONATO). Metallic Crystallisation by Electric Currents	ii, 339
HISSINK (D. J.). Formation and Transition of Mixed Crystals of Sodium and Potassium Nitrates, and of Sodium and Silver Nitrates	ii, 339
SCHENCK (RUDOLF). [Crystalline Liquids]	ii, 339
CLARKE (FRANK WIGGLESWORTH). Report of the [American] Committee on Atomic Weights	ii, 339
EMICH (FRIEDRICH) and FRIEDRICH DÖRNER. Lecture Experiment on the Law of Multiple Proportions	ii, 340
RIBAN (JOSEPH). New Gasometer of Constant Pressure, adjustable at will	ii, 340

Inorganic Chemistry.

VORLÄNDER (DANIEL) and RUDOLF VON SCHILLING. Preparation and Properties of Anhydrous Perchloric acid	ii, 340
ARONSTEIN (LOUIS) and S. H. MEIHZUZEN. Molecular Weight of Sulphur as determined by the Boiling Point method	ii, 341
MOISSAN (HENRI) and PAUL LEBEAU. Sulphur Perfluoride, a New Gas	ii, 341
MOISSAN (HENRI) and PAUL LEBEAU. Density and Analysis of Sulphur Perfluoride	ii, 342
SCHLAGDENHAUFFEN (CHARLES F.) and C. PAGEL. Sulphuric acid containing Selenium	ii, 342
RAYLEIGH (JOHN WILLIAM STRUTT [BARON]). Passage of Argon through thin films of India-rubber	ii, 342
FOERSTER (FRITZ) and F. JORRE. Electrolysis of Alkali Chloride Solutions with a Diaphragm	ii, 343
SCHULTEN (AUGUST BENJAMIN [BARON] DE). Production of Iodated Potassium and Sodium Carnallites	ii, 343
CORDIER (V. VON). Action of Chlorine on Metallic Silver in the Light and in the Dark	ii, 343
GEELMUYDEN (H. CHR.). Reducing Action of Calcium Carbide	ii, 344
FORCRAND (ROBERT DE). Hydrated Barium Peroxide	ii, 344

	PAGE
FORCRAND (ROBERT DE). Heat of Formation of Hydrated and Anhydrous Strontium Dioxide	ii, 344
CAVEN (ROBERT MARTIN). Reaction of Magnesium, Zinc, and Iron with Solutions of Cupric Sulphate	ii, 344
SCHIRBER (W.). Influence of Ammonia on Magnesium Salts	ii, 345
MORGAN (J. LIVINGSTON R.). Electrolytic Deposition of Brass	ii, 345
FONZES-DIACON (HENRI). Zinc Selenide and its Dimorphism	ii, 345
SCHULTEN (AUGUST BENJAMIN [BARON] DE). Production of Cadmium Vanadinites	ii, 346
PÉLABON (H.). Action of Hydrogen on Mercury Selenide, and the Inverse Action	ii, 346
FRANÇOIS (MAURICE). Formation of Mercuriammonium Iodide by the Regulated Action of Concentrated Ammonia on Mercuridiammonium Iodide	ii, 346
URBAIN (G.). Separation of the Rare Earths	ii, 346
CHAVASTELON (R.). Separation of the Rare Earths	ii, 346
DEMARÇAY (EUGÈNE). New Method of Fractionating some Rare Earths	ii, 347
PÉIBRAM (RICHARD). Austrium	ii, 347
ZUNINO (V.). New Hydrate of Alumina	ii, 348
GIORGIS (GIOVANNI) and UGO ALVISI. Natural and Artificial Pozzuolana	ii, 348
FONZES-DIACON (HENRI). A Crystallised Selenide and an Oxy-selenide of Manganese	ii, 348
BREUKELEVEEN (M. VAN) and A. TER HORST. Iron Carbonyls and their Importance in the Industrial Applications of Water Gas	ii, 349
SCHARIZER (RUDOLF). Constitution and Genesis of Iron Sulphates	ii, 349
GRANGER (ALBERT) and GASTON DIDIER. Nickalous Arsenide	ii, 349
LENHER (VICTOR) and HERMANN A. LOOS. Decomposition of Nickel Carbonyl in Solution	ii, 349
VENABLE (FRANCIS PRESTON). Nature of the Change from Violet to Green in Solutions of Chromium salts	ii, 349
BAUGÉ (GEORGES). Double Carbonates of Chromium Oxide: Saline Oxide of Chromium	ii, 349
PAGEL (C.J.). Preparation of Double Sulphates of Chromium	ii, 349
DEFACQZ (ED.). Tungsten Diphosphide	ii, 350
HALLOPEAU (L. A.). Paratungstates	ii, 350
DEBIERNE (A.). Actinium: a new Radio-active Element	ii, 350
ROSENHEIM (ARTHUR) and JOHANNES SCHILLING. Thorium salts	ii, 351
RUTHERFORD (E.). A Radio-active Substance emitted from Thorium compounds	ii, 351
RUTHERFORD (E.). Radio-activity produced in substances by the action of Thorium compounds	ii, 352
PÉLABON (H.). Action of Hydrogen on Antimony Sulphide	ii, 352
SCHULTEN (AUGUST BENJAMIN [BARON] DE). Crystallised Bismuth salts	ii, 353

Mineralogical Chemistry.

EICHLEITER (C. FRIEDRICH). Coals, Bitumen, &c., from the Silurian of Bohemia	ii, 354
JEREMÉEFF (PAVEL V. VON). Carnassite from the Altai	ii, 354
JEREMÉEFF (PAVEL V. VON). Pseudomorphs after Olivine from the Urals	ii, 354
TARASSENKO (W.). Composition of Plagioclase	ii, 354
PRESTON (H. L.). Two new American Meteorites	ii, 355
BOURCET (PAUL). Water from Jouhe, near Dôle (Jura)	ii, 355

Physiological Chemistry.

	PAGE
LÜHRIG (H.). Relative Digestibility of certain Fats in the Human Intestine. IV. Lard Substitute ("Kunstspeisefett")	ii, 355
ROSEMAN (RUDOLF). The Proteid-sparing action of alcohol	ii, 356
BANG (IVAR). Parachymosin	ii, 356
OKER-BLOM (MAX.). Animal Juices and Tissues from the Physico-chemical Standpoint. II. Influence of the Blood Corpuscles on the Electrical Conductivity of Blood. Effect of Suspended Particles generally on Conductivity	ii, 356
BORDIER (H.). Specific Heat of Blood	ii, 356
BERTHELOT (MARCELLIN PIERRE EUGENE). Specific Heat of Blood	ii, 357
LOEWY (A.). Oxygen in Human Blood	ii, 357
EDDMANN (ERNST). The Sense of Smell and the most important Perfumes	ii, 357
LOEB (JACQUES). Different Effect of Ions on Animal Tissues	ii, 357
OSWALD (AD.). Chemistry and Physiology of the Thyroid	ii, 358
ESCHBAUM (FRIEDRICH). Elimination of Mercury by Patients treated with this Metal	ii, 358
ROSENFELD (G.). [Elimination of] Carbohydrates [in Urine]	ii, 358
ALDRICH (T. B.) and E. M. HOUGHTON. Pharmacology of Chloretone (Acetonechloroform)	ii, 358
BRUNI (GIUSEPPE). Physiological Action of Formaldehyde	ii, 359
BENEDICENTI (ALBERICO) and ORESTE POLLEDRO. [Physiological Action of] Mercury derivatives of Aromatic Amines	ii, 359

Chemistry of Vegetable Physiology and Agriculture.

STUTZER (ALBERT) and R. HARTLER. Bacteria which destroy Nitrates	ii, 359
ROGÓYSKI (CASIMIR). Denitrification and Decomposition of Animal Matters in Soil	ii, 360
STOKLASA (JULIUS). Importance of Bacteria for the Development of Plants	ii, 360
KOLKOWITZ (R.). Influence of Light on the Respiration of Lower Fungi	ii, 361
GRÜSS (J.). Production of Sucrose from Dextrose in the Cell	ii, 361
MÜLLER-THURGAU (HERMANN). Influence of Nitrogen on the Growth of Plants	ii, 361
CHARABOT (EUGENE). Metamorphoses and Migrations of compounds of the Linalool Group in Plants	ii, 361
CHARABOT (EUGENE). Influence of Active Vegetable Growth on the Formation of Thujone and Thujol	ii, 362
RADAIS (MAXIME). Pure Culture of a Green Alga. Formation of Chlorophyll in the Dark	ii, 362
LE SUEUR (HENRY RONDEL). Oil of <i>Carthamus tinctorius</i> (Safflower Oil)	ii, 362
COUPIN (HENRI). Toxic Action of compounds of the Alkaline Earth Metals towards the Higher Plants	ii, 363
GROSS (EMANUEL). Assimilation by Plants in Soils containing different amounts of Sand	ii, 363
JOHANNSEN (WILHELM [LUDWIG]). Relation between the Weight and the Percentage of Nitrogen in Barley Grain	ii, 363
ANCONA (GIUSEPPE D'). Fenugreek	ii, 364
SOHNDEWIND (W.). Amount of Mineral Matter and of Nitrogen in Sugar-beet variously Manured and in different Soils	ii, 364
JENKINS (EDWARD H.) and W. E. BRITTON. Use of Commercial Fertilisers for Forcing-house Crops	ii, 365
WILFARTH (H.) and G. WIMMER. Vegetation Experiments with Sugar-beet	ii, 365
WILFARTH (H.). Does Nitrogenous Manure injure Succeeding Crops when applied to Sugar-beet?	ii, 366

Analytical Chemistry.

	PAGE
GAUTIER ([ÉMILE JUSTIN] ARMAND). Gas Absorption Apparatus . . .	ii, 366
AUZENAT (R.). Estimation of Iodic acid in Sodium Nitrate . . .	ii, 366
LUNGE (GEORG) and D. SEGALLER. Estimation of Sulphites and Thio- sulphites in the Presence of each other . . .	ii, 366
HERZFELD (ALEXANDER). Estimation of Phosphoric acid soluble in a 2 per cent. Solution of Citric acid . . .	ii, 367
FISCHER (BERNHARD). Volumetric Estimation of Boric acid . . .	ii, 367
SALVADORI (ROBERTO) and G. PELLINI. Colorimetric Method for the Esti- mation of Silica in Mineral Waters . . .	ii, 367
SCARLATÁ (GIUSEPPE). Mechanical Analysis of Soils: Separation of Clay and Sand . . .	ii, 368
HOEHNEL (M.). Detection of Mercury in Urine . . .	ii, 368
ESCHBAUM (FRIEDRICH). Clinical Estimation of Mercury in Urine. Elimina- tion of Mercury in Patients treated with this Metal . . .	ii, 368
MARIE (CH.). Electrolytic Estimation of Lead in the Sulphate and Chromate. Application to the Analysis of Lead-glass and Lead Chromates . . .	ii, 368
CLARK (JOHN). Analysis of Copper . . .	ii, 369
CLENNELL (J. E.). Estimation of Copper in Cyanide Solutions . . .	ii, 370
GUICHARD (MARCEL). Analysis of Molybdenum Sulphides . . .	ii, 370
WÖRNER (EMIL). Phosphotungstic acid as a Reagent for Potassium . . .	ii, 370
CLARK (JOHN). Separation of Bismuth from Lead . . .	ii, 371
DÖRING (THEODOR). Detection of minute quantities of Gold in Ores . . .	ii, 371
POZZI-ESCOT (M. E.) and H. C. COUQUET. New Microchemical Reaction of Palladium . . .	ii, 371
MIETZSCHKE (W.). Estimation of Iridium in Alloys of the Noble Metals . . .	ii, 371
SHUTTLEWORTH (A. E.). Method and Apparatus for Incinerating Vegetable and Animal Substances . . .	ii, 372
COLMAN (HAROLD G.) and JAMES F. SMITH. Estimation of Naphthalene in Coal Gas . . .	ii, 372
LEHMANN (MARTIN). Volumetric estimation of Iodoform in Dressings . . .	ii, 372
ROSENHEIM (OTTO) and PHILIP SCHIDROWITZ. Some Analyses of Modern Dry Champagne . . .	ii, 372
BERGELL (PETER) and FERDINAND BLUMENTHAL. Isolation of Pentose and Methylpentose [from Urine] . . .	ii, 373
FREYER (FRANZ). Estimation of Sugar in Glycerin-Soaps . . .	ii, 373
STANĚK (VL.). Automatic Apparatus for the Estimation of Pentosans . . .	ii, 373
WOLFF (JULES). Estimation of Formaldehyde . . .	ii, 373
CONROY (JAMES TERENCE). Testing of Acetone . . .	ii, 374
SCHMIDT (R.). Examination of Violet Preparations for Ionone . . .	ii, 375
MUSPRATT (MAX.). Estimation of Propionic and Butyric acids in Acetic acid . . .	ii, 375
LEWKOWITSCH (JULIUS). Separation of Oleic acid from other Fatty acids . . .	ii, 376
MOORE (RUSSELL W.). Free Fatty acids in Olive Oil . . .	ii, 376
WIS (J. J. A.). Determination of the Iodine Value . . .	ii, 376
MARSHALL (ARTHUR). The Iodine Value of Oils . . .	ii, 376
LEONARD (NORMAN). Relation between the Specific Gravity, Fat, and Solids not Fat in Milk . . .	ii, 376
MORPURGO (GIULIO) and ALB. GÖTZL. Adulteration of Cotton Seed Oil with Maize Oil . . .	ii, 377
FASCETTI (G.) and F. GHIGI. Detection of Margarine in Cheese . . .	ii, 377
SMETHAM (ALFRED) and F. ROBERTSON DODD. Some Properties of Rosin with Special Reference to the Analysis of Fatty matter in Soap . . .	ii, 377
TRUCHON (R.). Detection of "Saccharin" in articles of Food . . .	ii, 377
TRUBECK (M.). Technical Analysis of Liquorice Pastes . . .	ii, 378
DENIGÈS (GEORGES). Colour Reactions of Tyrosine . . .	ii, 378
EDLEFSSEN (G.). Detection of Phenetidine in Urine . . .	ii, 378

	PAGE
HOFFMANN (PAUL). Reactions of Antipyrine, Tolypyrine, Aminoantipyrine, and Pyramidone	ii, 379
MOOR (CRESACE G.) and MARTIN PRIEST. Coffee Extracts, their Composition and Analysis	ii, 379
SCHMIDT (ERNST). Estimation of the Alkaloids of the Leaves of <i>Datura Stramonium</i> , <i>Hyoscyamus niger</i> , and <i>Atropa Belladonna</i>	ii, 379
SCHINDELMEISER (IWAN). Detection of Nicotine	ii, 380
HEINEMANN (ADOLF). Ullmann's Tests for Tanning Materials and Basic Colours used in Dyeing	ii, 380
CHAPMAN (ALFRED CHASTON). Distinguishing between Hops and Quassia	ii, 380

INDEX OF AUTHORS' NAMES.

A.

Abel, J. J., i, 368.
 Alberda van Ekenstein, W. See C. A. L. de Bruyn.
 Aldrich, T. B., and E. M. Houghton, ii, 358.
 Allen, R. W., i, 339.
 Alvisi, U. See Giorgis, G.
 Ancona, G. d', ii, 364.
 Aronstein, L., and S. H. Meihuizen, ii, 341.
 Astre, C. See J. Ville.
 Auzenat, R., ii, 366.

B.

Baeyer, A. von, and V. Villiger, i, 328.
 Bamberger, E., M. Baum, L'Orsa, A. Stiegelmann, and F. Tschirner, i, 341.
 Bamberger, E., and F. Tschirner, i, 342.
 Bang, I., ii, 356.
 Barnes, J., ii, 332.
 Bary, P., ii, 330.
 Baugé, G., ii, 349.
 Baum, M. See E. Bamberger.
 Bemmelen, J. M. van, and E. A. Klobbie, ii, 338.
 Bénech, E., i, 340.
 Benedicenti, A., and O. Polledro, ii, 359.
 Bergell, P., and F. Blumenthal, ii, 373.
 Berthelot, D., ii, 335, 337.
 Berthelot, M., ii, 329, 357.

Berthelot, M., and M. Delépine, i, 324; ii, 334.
 Beutel, E., i, 367.
 Bischoff, C. A., i, 345.
 Blaise, E. E., i, 329.
 Blanc, G., i, 329.
 Bloxam, W. P., TRANS., 753.
 Blumenthal, F. See P. Bergell.
 Bocchi, O., i, 357.
 Boehm, C. See H. Pauly.
 Boeseken, J., i, 349.
 Bordier, H., ii, 356.
 Bougault, J., i, 361.
 Bourcet, P., ii, 355.
 Breukeleveen, M. van, i, 343.
 Breukeleveen, M. van, and A. ter Horst, ii, 348.
 Britton, W. E. See E. H. Jenkins.
 Bruni, G., ii, 359.
 Brunner, K., i, 360.
 Brussoff, S., i, 322.
 Bruyn, C. A. L. de, and W. Alberda van Ekenstein, i, 332.
 Bullheimer, F., and E. Seitz, i, 330.

C.

Calvert, H. T., ii, 331.
 Cameron, F. K. See J. A. Emery.
 Caven, R. M., ii, 344.
 Censi, J., i, 363.
 Chapman, A. C., ii, 380.
 Charabot, E., ii, 361, 362.
 Chavastelon, R., ii, 346.
 Chilesotti, A., i, 339.
 Clark, J., ii, 369, 371.
 Clarke, F. W., ii, 339.
 Clennell, J. E., ii, 370.
 Cohn, P., i, 350.

Cohn, P., and S. Tauss, i, 350.
 Cojazzi, F., i, 327.
 Colman, H. G., and J. F. Smith,
 ii, 372.
 Colman, J. See S. Gabriel.
 Conroy, J. T., ii, 374.
 Cordier, V. von, 343.
 Coupin, H., ii, 363.
 Couquet, H. C. See M. E. Pozzi-
 Escot.

D.

Debierne, A., ii, 350.
 Defacqz, E., ii, 350.
 Delépine, M. See M. Berthelot.
 Demarçay, E., ii, 347.
 Denigès, G., ii, 378.
 Didier, G. See A. Granger.
 Döring, T., ii, 371.
 Dörner, F. See F. Emich.
 Dodd, F. R. See A. Smetham.
 Du Bois, H., and O. Liebknecht,
 ii, 333.
 Duhem, P., ii, 338.

E.

Eder, J. M., and E. Valenta, ii, 330.
 Edlefsen, G., ii, 378.
 Eichleiter, C. F., ii, 354.
 Emery, J. A., and F. K. Cameron,
 ii, 335.
 Emich, F., and F. Dörner, ii, 340.
 Erdmann, E., ii, 357.
 Ernst. See J. Tambor.
 Esch, W., and W. Marckwald, i, 336.
 Eschbaum, F., ii, 368.

F.

Fascetti, G., and F. Ghigi, ii, 377.
 Fels, G., i, 338.
 Feuerstein, W. See S. von Kos-
 tanecki.
 Fichter, F., and E. Schiess, i, 366.
 Fischer, B., ii, 367.
 Foerster, F., and F. Jorre, ii, 343.
 Fonzes-Diacon, H., ii, 345, 348.
 Forcrand, R. de, ii, 344.
 François, M., ii, 346.
 Freyer, F., ii, 373.

G.

Gabriel, S., and J. Colman, i, 358,
 359.
 Gadamer, J., i, 356.

Gautier, A., ii, 366.
 Geelmuyden, H. C., ii, 344.
 Genvresse, P., i, 361.
 Georgescu, M., i, 343.
 Ghigi, F. See G. Fascetti.
 Giorgis, G., and U. Alvisi, ii, 348.
 Gockel, A., ii, 332.
 Götzl, A. See G. Morpurgo.
 Goldschmidt, H., and G. Keppeler,
 i, 367.
 Granger, A., and G. Didier, ii, 349.
 Gronover, A. See A. Partheil.
 Gross, E., ii, 363.
 Grüss, J., ii, 361.
 Guichard, M., ii, 370.

H.

Haeussermann, C., i, 365.
 Hallopeau, L. A., ii, 350.
 Hantzsch, A., i, 365.
 Harries, C. D., i, 331.
 Hartleb, R. See A. Stutzer.
 Heinemann, A., ii, 380.
 Helfenstein, A. See R. Lorenz.
 Henze, M., i, 347.
 Herz, W., ii, 387.
 Herzfeld, A., ii, 367.
 Hissink, D. J., ii, 339.
 Hoehnel, M., ii, 368.
 Hoffmann, P., ii, 379.
 Horst, A. ter. See M. van Breuke-
 leven.
 Hosking, R., ii, 336.
 Houghton, E. M. See T. B.
 Aldrich.
 Howells, V. A. See C. Willgerodt.

J.

Jebenko, A. See M. I. Konowaloff.
 Jenkins, E. H., and W. E. Britton,
 ii, 365.
 Jereméeff, P. V. von, ii, 354.
 Johannsen, W. L., ii, 363.
 Jorre, F. See F. Foerster.

K.

Kasanezky, P. See P. I. Petrenko-
 Kritschenko.
 Keppeler, G. See H. Goldschmidt.
 Kerschbaum, M., i, 353.
 Kerschbaum, M. See also F. Tie-
 mann.
 Kijner, N. M., i, 333.
 Kley, P., i, 346.

Klobbie, E. A. See J. M. van Bem-
melen.
Kötz, A., and Sevin, i, 343.
Kolkwitz, R., ii, 361.
Konowaloff, M. I., i, 324, 352.
Konowaloff, M. I., A. Jebenko, and
S. Kotsina, i, 324.
Konowaloff, M. I., and W. Plotni-
koff, i, 323.
Kostanecki, S. von, and W. Feuer-
stein, i, 355.
Kotsina, S. See M. I. Konowaloff.
Kudernatsch, R., i, 337.

L.

Lander, G. D., TRANS., 729.
Lebeau, P. See H. Moissan.
Lees, C. H., ii, 333.
Lefebvre, P., i, 323.
Lehmann, M., ii, 372.
Lenher, V., and H. A. Loos, ii, 349.
Leonard, N., ii, 376.
Le Sueur, H. R., ii, 362.
Lewkowitsch, J., ii, 376.
Liciński. See J. Tambor.
Liebermann, C., i, 355.
Liebknecht, O. See H. du Bois.
Loeb, J., ii, 357.
Löwenherz, R., ii, 338.
Loewy, A., ii, 357.
Loomis, E. H., ii, 335.
Loos, H. A. See V. Lenher.
Lorenz, R., and A. Helfenstein,
ii, 335.
L'Orsa. See E. Bamberger.
Lührig, H., ii, 355.
Luginin, W. P., ii, 334.
Lunge, G., and D. Segaller, ii, 366.

M.

MacGregor, J. G., ii, 332.
McKee, R. H. See J. Stieglitz.
Marckwald, W., i, 336.
Marckwald, W. See W. Esch.
Marie, C., ii, 368.
Marshall, A., ii, 376.
Massoulier, P., ii, 331.
Mathews, J. A., i, 323.
Mathews, J. A., and L. L. Watters,
i, 323.
Maximevitch, S., ii, 325.
Meihuizen, S. H. See L. Aronstein.
Mellor, J. W., ii, 334.
Menschutkin, B. N. See A. Wolkoff.
Menschutkin, N. A., i, 335, 337, 341.
Michael, A., i, 321.
Mietzschke, W., ii, 371.

Möhlau, R., and W. Schaposchni-
koff, i, 367.
Möhlau, R., and E. Strohbach,
i, 368.
Moissan, H., and P. Lebeau, ii, 341,
342.
Moore, C. G., and M. Priest, ii, 379.
Moore, R. W., ii, 376.
Morgan, J. L. R., ii, 345.
Morpurgo, G., and A. Götzl, ii, 377.
Moschner, J., i, 344.
Müller-Thurgau, H., ii, 361.
Muspratt, M., ii, 375.
Musselius, L., i, 334.

N.

Naef, E. See F. Ullmann.
Nef, J. U., i, 349.

O.

Oker-Blom, M., ii, 356.
Oswald, A., ii, 358.

P.

Pagel, C., ii, 349.
Pagel, C. See also C. F. Schlagden-
hauffen.
Partheil, A., and A. Gronover
i, 368.
Pauly, H., and C. Boehm, i, 357.
Pélabon, H., ii, 346, 352.
Pellini, G. See R. Salvadori.
Perrier, G., i, 331, 350, 352.
Petrenko-Kritschenko, P. I., and
P. Kasanerzky, i, 350.
Plotnikoff, W. See M. I. Konowaloff.
Pokrovsky, A., i, 328.
Polledro, O. See A. Benedicenti.
Ponsot, A., i, 333; ii, 337.
Pozzi-Escot, M. E., and H. C.
Conquet, ii, 371.
Preston, H. L., ii, 355.
Přibram, R., ii, 347.
Priest, M. See C. G. Moore.

R.

Radais, M., ii, 362.
Rayleigh, Lord, ii, 342.
Ribau, J., ii, 340.
Rogóyski, C., ii, 360.
Rosemann, R., ii, 356.
Rosenfeld, G., ii, 358.
Rosenheim, A., and J. Schilling,
ii, 351.

Rosenheim, O., and P. Schidrowitz,
ii, 372.
Rosset, G., ii, 386.
Rutherford, E., ii, 351, 352.

S.

Sachs, F., i, 362.
Salvadori, R., and G. Pellini,
ii, 367.
Scarlata, G., ii, 368.
Schaposchnikoff, W. See R.
Möhlau.
Scharizer, R., ii, 349.
Schenk, R., ii, 339.
Schidrowitz, P. See O. Rosenheim.
Schieber, W., ii, 345.
Schless, E. See F. Fichter.
Schilling, J. See A. Rosenheim.
Schilling, R. von. See D. Vor-
länder.
Schindelmeyer, I., ii, 380.
Schlagdenhauffen, C. F., and C.
Pagel, ii, 342.
Schmidt, E., ii, 379.
Schmidt, J., i, 332.
Schmidt, R., ii, 375.
Schneidewind, W., ii, 364.
Scholl, R., and W. Nörr, i, 337.
Schulten, A. de, ii, 343, 346, 353.
Segaller, D. See G. Lunge.
Seitz, E. See F. Bullnheimer.
Semmler, F. W., i, 351.
Sevin. See A. Kötze.
Seyewetz, A., i, 356.
Shuttleworth, A. E., ii, 372.
Siertsema, L. H., ii, 329.
Smetham, A., and F. R. Dodd,
ii, 377.
Smith, J. F. See H. G. Colman.
Smith, S. W. J., ii, 330.
Sodeau, W. H., TRANS., 717.
Staněk, V., ii, 373.
Stefani, P. D., i, 349.
Stiegelmann, A. See E. Bamberger.
Stieglitz, J., and R. H. McKee,
i, 340.
Stoklasa, J., ii, 360.
Stolle, F., i, 333.
Strömholm, D., i, 325.
Strohbach, E. See P. Möhlau.
Stutzer, A., and R. Hartleb, ii, 359.
Šulc, O., ii, 332.

T.

Talanzeff, Z., i, 328.
Tambor, J. Ernst, and Liciński,
i, 364.

Tarassenko, W., ii, 354.
Taus, S. See B. Cohn.
Taylor, R. L., TRANS., 725.
Thiele, J., i, 347.
Tiemann, F., and M. Kerschbaum,
i, 331.
Tommasi, D., ii, 339.
Tower, O. F., ii, 331.
Trubeck, M., ii, 378.
Truchon, R., ii, 377.
Tschirner, E. See E. Bamberger.
Tschugaeff, L., i, 352.

U.

Ullmann, F., and E. Naef, i, 360, 361.
Urbain, G., ii, 346.

V.

Valenta, E. See J. M. Eder.
Vandenbergh, A., ii, 335.
Vanzetti, L., i, 327.
Venable, F. P., ii, 349.
Ville, J., and C. Astre, i, 362.
Villiger, V. See A. von Baeyer.
Vorländer, D., and R. von Schilling,
ii, 340.
Votoček, E., i, 332, 355.

W.

Watters, L. L. See J. A. Mathews.
Weber, C. O., i, 353.
Wedel, J., i, 363.
Widman, O., i, 347.
Wilfarth, H., ii, 366.
Wilfarth, H., and G. Wimmer, ii, 365.
Wij, J. J. A., ii, 376.
Willgerodt, C., i, 339.
Willgerodt, C., and V. A. Howells,
i, 338.
Wimmer, G. See H. Wilfarth.
Wislicenus, W., i, 346.
Wörner, E., ii, 370.
Wolf, C. G. L., i, 345.
Wolff, J., ii, 378.
Wolkoff, A., and B. N. Menschutkin,
i, 321.

Z.

Zernoff, W., i, 327.
Zunino, V., ii, 348.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
LXV.—Hydrosulphides, Sulphides, and Polysulphides of Potassium and Sodium. By W. POPPLEWELL BLOXAM, B.Sc. (Continued)	769
LXVI.—Chlorine Derivatives of Pyridine. Part VI. Orientation of some Chloraminopyridines. By W. J. SELL, M.A., F.R.S., and F. W. DOORSON, M.A.	771
LXVII.—Note on Partially Miscible Aqueous Inorganic Solutions. By G. S. NEWTH	775
LXVIII.—Racemic and Optically Active Forms of Amarine. By H. LLOYD SNAPE, D.Sc., Ph.D.	778
LXIX.—Substituted Nitrogen Chlorides and Bromides derived from <i>o</i> - and <i>p</i> -Acetotoluidide. By F. D. CHATTAWAY and K. J. P. ORTON	789
LXX.—Ortho-substituted Nitrogen Chlorides and Bromides and the Entrance of Halogen into the Ortho-position in the Transformation of Nitrogen Chlorides. By F. D. CHATTAWAY and K. J. P. ORTON	797
LXXI.—Nitrogen Chlorides derivable from <i>m</i> -Chloroacetanilide and their Transformation. By F. D. CHATTAWAY, K. J. P. ORTON, and W. H. HURLEY	800
LXXII.—Condensation of Ethyl Acetylenedicarboxylate with Bases and β -Ketonic Esters. By SIEGFRIED RUHEMANN and H. E. STAPLETON, B.A., Scholar of St. John's College, Oxford	804
LXXIII.—Bromination of Benzeneazophenol. Part II. By JOHN THEODORE HEWITT and WILLIAM GEORGE ASTON	810

	PAGE
LXXIV.—Action of Formaldehyde on Amines of the Naphthalene Series. Part II. By GILBERT THOMAS MORGAN, D.Sc.	814
LXXV.—Estimation of Hypiodites and Iodates and the Reaction of Iodine Monochloride with Alkalis. By K. J. P. ORTON and W. L. BLACKMAN	830
LXXVI.—Researches on Silicon Compounds. Part VI. On Silicodiphenyldiimide and Silicotriphenylguanidine. By J. EMERSON REYNOLDS, D.Sc., M.D., F.R.S.	836
LXXVII.—A Study of the Absorption Spectra of <i>o</i> -Oxycarbanil and its Alkyl Derivatives in relation to Tautomerism. By WALTER NOEL HARTLEY, F.R.S., JAMES J. DOBBIE, D.Sc., M.A., and PHOTIOS G. PALIATSEAS	839
LXXVIII.—Ultra-violet Absorption Spectra of Some Closed Chain Carbon Compounds. Part II. Dimethylpyrazine, Hexamethylene, and Tetrahydrobenzene. By WALTER NOEL HARTLEY, F.R.S., and JAMES J. DOBBIE, D.Sc., M.A.	846
LXXIX.—The Constitution of Pilocarpine. Part I. By HOOPER ALBERT DICKINSON JOWETT, D.Sc.	851
LXXX.—Isomeric Partially Racemic Salts containing Quinquevalent Nitrogen. Parts I—VI. Hydrindamine Bromocamphorsulphonates, Chlorocamphorsulphonates, and <i>cis</i> - π -Camphanates. By FREDERIC STANLEY KIPPING, Ph.D., D.Sc., F.R.S.	861
LXXXI.—Constitution of Ethyl Sodiocyanacetate and of Ethyl Sodiomethylcyanacetate. By JOCELYN FIELD THORPE	923
LXXXII.— <i>cis</i> - and <i>trans</i> - α,β -Tetramethylglutaric Acids. By JOCELYN F. THORPE and WILLIAM J. YOUNG	936
LXXXIII. β -Isopropylglutaric Acid and <i>cis</i> - and <i>trans</i> -Methylisopropylglutaric Acids. By F. H. HOWLES, JOCELYN F. THORPE, WILLIAM UDALL, and, in part, H. A. NEALE	942
LXXXIV.—The Persulphuric Acids. By T. MARTIN LOWRY, D.Sc., and JOHN H. WEST	950

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

	PAGE
BAYLEY (THOMAS). Relation between Boiling Point and Melting Point in the Hydrocarbons	i, 369
BAUD (E.). Action of Anhydrous Aluminium Chloride on Acetylene	i, 369
POURET (CHARLES). Bromination by means of Aluminium Bromide	i, 369
KÖTZ (ARTHUR). Reactivity of the Hydrogen Atoms in Disulphones, Trisulphones, and Tetrasulphones	i, 369
GABUTTI (EMILIO). Action of Chloral on the Chloroacetic acids	i, 370
VANINO (LUDWIG) and EMIL UHLFELDER. Organic Peroxides. IV.	i, 371
RUPE (HANS). Cineolic acid	i, 371
HALLER (ALBIN). Preparation of Ethyl β -Alkyloxy- α -cyanocrotonates isomeric with Ethyl Cyanoalkylacetoacetates	i, 372
GOLDSCHMIDT (HEINRICH) and LAZAR OSLAN. Ethyl Acetoacetate. II.	i, 373
CLAIREN (LUDWIG) and E. HAASE. Acetylation of Ethyl Acetoacetate	i, 373
MAROH (F.). Action of Ethyl Chloroacetate on Sodioacetylacetone	i, 374
MOLINARI (ETTORE). Conversion of Dimethylmaleic Anhydride into Dimethylfumaric acid	i, 374
FITTING (RUDOLPH). Formation of Oxalacetic acid by Oxidation with Potassium Permanganate in Alkaline Solution	i, 375
BAUDRAN (G.). [Tartar] Emetics	i, 375
PRUNIER (L. LÉON L.). General observation on "Emetics"	i, 376
SCHLOSSBERG (J.). Some Racemic Substances	i, 376
KNOBE (LUDWIG). Preparation of Acetonylacetone	i, 376
GRAY (THOMAS). Syntheses with Acetonylacetone	i, 376
BERTRAND (GABRIEL). Oxidation of Erythritol by the Sorbose Bacterium: Production of Erythrulose, a new Sugar	i, 377
SULAIMAN BEY. Pentoses and Methylpentoses	i, 377
SMITH (ROBERT H.) and BERNHARD TOLLENS. Compounds of Fructose (Lævulose) with the Haloid salts of the Alkaline Earth. Oxidation of Fructose	i, 378
SMITH (ROBERT H.) and BERNHARD TOLLENS. Polarisation and Reducing Power of Sorbose	i, 378
SCHÖNROCK (OTTO). Variation in the Specific Rotation of Sucrose with the Temperature	i, 378
OECHSNER DE CONINCK (WILLIAM). Stability of Sucrose Solutions	i, 378
HILGER (ALBERT) and W. E. DREYFUS. Gum Tragacanth	i, 379
LENHER (VICTOR). Some new Tellurium compounds	i, 379
LACHMAN (ARTHUR). Bewad's Triethylamine Oxide	i, 380
LACHMAN (ARTHUR). Diethylhydroxylamine	i, 380
LACHMAN (ARTHUR). Quinquevalent Nitrogen	i, 380
MIOLATI (ARTURO). Ammonio-cobalt Thiocyanates	i, 381
ROSENHEIM (ARTHUR) and ROBERT COHN. Double Thiocyanates	i, 381
GRIGNARD (V.). New Organo-metallic compounds of Magnesium, and their application to the Synthesis of Alcohols and Hydrocarbons	i, 382
LEY (HEINRICH). Chemistry of Mercury. II. Mercuric salts of Ketonic acids and the conversion of these into Mercuriketonic acids	i, 382
HOFMANN (KARL A.) [and in part W. BOSCH, E. EICHWALD, and JULIUS SAND]. Mercarbide, $C_2H_2O_2Hg_2$	i, 383
HOFMANN (KARL A.) and JULIUS SAND. Behaviour of Mercuric salts towards Olefines	i, 384

	PAGE
SAND (JULIUS) and KARL A. HOFMANN. Action of Propylene and Butylene on Mercuric salts	i, 385
SAND (JULIUS) and KARL A. HOFMANN. Action of Allyl Alcohol on Mercuric salts	i, 386
SCHOLL (ROLAND) and WILHELM NÖRR. Action of Cyanogen Bromide and Aluminium Chloride on Benzenoid Hydrocarbons and Phenol Ethers	i, 386
KLAGES (AUGUST) and C. LIECKE. Law governing the Elimination of Halogens from the Benzene Ring	i, 387
HOLLEMAN (ARNOLD FREDERIK). Formation of Trisubstituted from Disubstituted Benzene derivatives	i, 387
SOMMER (F.). <i>m</i> -Xylylamine and <i>m</i> -Methylphenylethylamine	i, 388
PECHMANN (HANS VON) and OTTO ANSEL. Hydroxyethylidenexanilide	i, 389
JUNGHAHN (ALFRED). Sulphonic acids of Acetylxylylidine	i, 389
TRAUBE (WILHELM) and ERNST VON WEDELSTÄDT. Phenylcyanamide	i, 389
DAINS (FRANK B.). Action of certain acid Reagents on Substituted Carbamides	i, 390
MARCKWALD (WILHELM). Colour of Picric acid and its Solutions	i, 391
FORSE (E.) and J. ETTLINGER. Action of Ethylidene Chloride on Phenols	i, 392
HILL (HENRY B.). 2:6-Diphenyl-4-nitrophenol and 2-Phenyl-4-nitrophenol	i, 392
PREUSS (L.) and A. BINZ. Preparation of Anthranilic acid from <i>o</i> -Nitrotoluene	i, 392
BISCHOFF (CARL ADAM). Formation of Chains. XLIV. The three Sodium Tolyloxides and Ethyl Esters of α -Bromo-fatty acids	i, 392
BISCHOFF (CARL ADAM). Formation of Chains. XLV. Sodium Xylyloxides and Ethyl Esters of α -Bromo-fatty acids	i, 393
BISCHOFF (CARL ADAM). Formation of Chains. XLVI. Sodium derivatives of Carvacrol, Thymol, and ψ -Cumenol, and Ethyl Esters of α -Bromo-fatty acids	i, 394
BISCHOFF (CARL A.) [and in part CON. DOWGALLO, KISLIANSKY, LIPSCHITZ, SIW, and SLOBODSKOI]. Formation of Chains. XLVII. Sodium Naphthylloxides and Ethyl Esters of α -Bromo-fatty acids	i, 395
BISCHOFF (CARL ADAM). Formation of Chains. XLVIII. Guaiacol derivatives	i, 396
BISCHOFF (CARL A.) [and in part BELAKOWSKI, GUNTREUM, KOCH, KEUSENSTIERN, MERGENTHAUER, RONTAL, and REUCHOWSKI]. Formation of Chains. XLIX. Derivatives of the three Ethyl Hydroxybenzoates	i, 396
FITTING (RUDOLPH). Isomeric Phenylparaconic acids	i, 397
MOUREU (CHARLES) and RAYMOND DELANGE. Acetylphenylacetylene and Benzoylphenylacetylene	i, 397
LABBÉ (HENRI). A Dihydrosulphonic acid derived from Carvone	i, 398
BERTRAM (JULIUS) and J. HELLE. <i>iso</i> -Fenchyl alcohol	i, 398
ASCHAN ([ADOLF] OSSIAN). Camphane	i, 399
ENGLER (CARL) [and in part J. WEISSBERG]. The rendering Active of Oxygen. IV., V., VI.	i, 399
BIGNAMI (CARLO) and GIUSEPPE TESTONI. Oil of Parsley	i, 400
SODEN (HUGO VON). Constituents of West Indian Sandal Wood Oil	i, 401
GUERBET (M.). Santalenes and Santalols	i, 401
FROMM (EMIL) [and in part W. LISCHKE]. Oil of Savin (<i>Oleum sabinae</i>). II.	i, 402
BEIJERINCK (MARTINUS WILLEM). Indigo Fermentation	i, 403
HAZEWINKEL (J. J.). Indican and its Enzyme	i, 403
HOOGWERFF (SEBASTIAAN) and H. TER MEULEN. Indican	i, 404
MARCHLEWSKI (LEO). Chemistry of Chlorophyll: Phyllorubin	i, 404
WILLSTÄTTER (RICHARD). Action of Potassium Permanganate on Bases	i, 404
WILLSTÄTTER (RICHARD) and FRITZ IGLAUER. Reduction of Tropinone to Tropine and Tropane	i, 404
WILLSTÄTTER (RICHARD). Synthesis of Hygric acid	i, 405
KLOBE ([CONSTANT] TIMOTHEE). Action of Phenylcarbimide and Aniline on γ -Ketonc acids	i, 405

	PAGE
ENGELS (OTTO). Addition of Formaldehyde to 2:4-Lutidine. Decomposition of 2:4-Lupetidine into its Optical Isomerides . . .	i, 406
MINOZZI (A.). Synthesis of Glutaric and Trimethylene derivatives . . .	i, 406
WALTHER (RUDOLF VON) and J. CLEMEN. 2-Methylketole . . .	i, 408
LADENBURG (ALBERT) and K. SCHOLTZE. 2-Methylpyridine-6-carboxylic acid . . .	i, 409
PINNER (ADOLF). Pyridinecarboxylic acids . . .	i, 409
PINNER (ADOLF) and J. LEWIN. 2-Methylpyridine-6-carboxylic acid . . .	i, 409
MOHR (ERNST). Conversion of Diethyl Lutidinedicarboxylate into Diaminolutidine . . .	i, 409
NEUBERG (CARL). Solubilities of Osazones . . .	i, 410
BUSCH (MAX) and EDMUND LINGENBRINK [and in part H. HOLZMANN]. Hydrazones of Dithiocarbonates . . .	i, 411
MCPHERSON (WILLIAM) and ROBERT FISCHER. Action of α -Acylated Phenylhydrazines on the Chlorine derivatives of Quinones . . .	i, 411
VILLE (JULES) and CHARLES ASTRE. New Mercuric Haloid derivatives of Antipyrine . . .	i, 411
BOBERT (MARSTON TAYLOR) and AUGUST HENRY GOTTHELF. New Synthesis in the Quinazoline Group . . .	i, 412
HARDIN (D.). Reactions in which Safranines are formed . . .	i, 412
HARRIES (CARL D.) and ERNST KLAMT. Action of Thiocynoacetic acid on Phenylhydrazine . . .	i, 413
BUSCH (MAX) and EDMUND LINGENBRINK. Action of Methyl Iodide on Dithiodiazolone Disulphides: Decomposition of Thiodiazolones . . .	i, 413
BUSCH (MAX) and PAUL BAUER. Products of the action of Hydrazine on Thiocarbamides . . .	i, 414
TRAUBE (WILHELM). A new Synthesis of Guanine and of Xanthine . . .	i, 416
FISCHER (EMIL). Aromatic derivatives of Uric acid . . .	i, 417
JUNGHAHN (ALFRED) and MAX NEUMANN. Aminoazobenzenetrisulphonic acid . . .	i, 418
AUWERS (KARL) [and G. MANN]. Constitution of Hydroxyazo-compounds . . .	i, 418
BORSCH (WALTHER). Benzeneazosalicylaldehyde . . .	i, 419
RIS (CHRISTOPH). Sulphur derivatives from <i>p</i> -Aminophenol and Hydroxyazobenzene . . .	i, 419
HARLAY (V.). Digestion of Fibrin and Albumin by Papain . . .	i, 419
HARLAY (V.). Action of Heat on Papain . . .	i, 420
ALBERT (ROBERT) and EDUARD BUCHNER. Yeast Extract and Precipitating Agents . . .	i, 420

PART II.

General and Physical Chemistry.

HASSELBERG (H.). Spectra of Metals in the Electric Arc. V. Spectrum of Vanadium . . .	ii, 381
BEOQUEREL (HENRI). Transparency to Aluminium to Radiations from Radium . . .	ii, 381
VILLARD (P.). Radiations from Radium . . .	ii, 381
ENGLISH (EUGEN). Theory of the Latent Image . . .	ii, 381
MOORE (T. SIDNEY). Reversibility of Voltaic Cells . . .	ii, 381
COHEN (ERNST). Alleged identity of Red and Yellow Mercuric Iodides. II. . .	ii, 381
FRANKLIN (EDWARD C.) and CHARLES A. KRAUS. Electrical Conductivity of Liquid Ammonia solutions . . .	ii, 382
WOLF (C. G. L.). Electrolysis of Sodium Chloride . . .	ii, 382

	PAGE
HELFFENSTEIN (A.). Application of Faraday's Law to the Electrolysis of Fused salts	ii, 383
DAWSON (HARRY M.) and P. WILLIAMS. Electrolytic Conductivity of Saturated Solutions	ii, 383
BINZ (A.) and A. HAGENBACH. Reducing action of Electrolytically deposited Metals	ii, 384
MILNER (S. ROBLINGTON). Theory of Solution Pressure	ii, 385
MEYER (STEFAN). Determination of some Coefficients of Magnetic Susceptibility	ii, 385
MEYER (STEFAN). Atomic and Molecular Magnetism	ii, 385
IKEDA (KIKUNAYE). Deduction of Reaction Isotherms and Isochors for systems involving dissociation	ii, 386
MASSOL (GUSTAVE). Overflowing Thermocalorimeter	ii, 386
FERRETTO (L.). Critical Temperatures of some Organic Sulphur compounds	ii, 386
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Heats of Combustion and Formation of Iodine Compounds	ii, 387
McCOY (HEBERT). Apparatus for determining Molecular Weights by the Boiling Point Method	ii, 387
SMITS (A.). A Manostat	ii, 388
HIRSCH (RUDOLF [FRIEDRICH] VON). Disturbing influences at the critical point of Pure Liquids and Mixtures	ii, 388
SMITS (A.). Determination of the decrease in the Vapour Tension of Solutions by means of the determination of the increase of the Boiling Point	ii, 389
GAHL (R.). Theory of Vapour Pressure	ii, 389
CAUBET (F.). Liquefaction of Gaseous Mixtures of Carbon Dioxide and Sulphur Dioxide	ii, 390
DONNAN (FREDERICK GEORGE). Relative Rates of Effusion of Argon, Helium, and some other Gases	ii, 390
WHETHAM (W. C. DAMPIER). Dissociation in Dilute Solutions at 0°	ii, 390
RICHARDS (THEODORE WILLIAM). Relation of the Taste of acids to their degree of Dissociation	ii, 391
IKEDA (KIKUNAYE). Simple proof of van't Hoff's Osmotic Pressure Law	ii, 391
RYDBERG (JOHANNES ROBERT). Hardness of Elementary Substances	ii, 392
PONSOT (A.). Limited Chemical Reactions in Homogeneous Systems: Modulus Law	ii, 392
LINCOLN (AZARIAH T.). Physical Reactions and the Mass Law	ii, 392
SCHREINEMAKERS (FRANS ANTOON HUBERT). Equilibria in the System: Water, Phenol, and <i>d</i> -Tartaric or Racemic Acid	ii, 393
SCHREINEMAKERS (FRANS ANTOON HUBERT). Equilibria in the System: Water, Phenol, and Acetone	ii, 393
KRUG (W. H.) and FRANK K. CAMERON. The System: Water, Phenol, and Hydrochloric acid	ii, 393
GEIGER (M.). Velocity of Reaction of Acids in Organic Solvents	ii, 394
CAJOLA (A.) and A. CAPPELLINI. Hydrolysis in Organic Solvents	ii, 394
MORELLO (ANTONIO). Energy of Acids dissolved in Mixtures of Organic Solvents and Water	ii, 395
SULC (OTTO KARL). Hydrolysis of Polysaccharides and Decomposition of Esters; Catalytic Action of some Metals	ii, 395
KOELICHEN (KARL). Chemical Dynamics of the Condensation of Acetone	ii, 395
TOUREN (CHARLES). Solubility of a Mixture of two Salts having a Common Ion	ii, 396
HARDY (W. B.). Mechanism of Gelation in Reversible Colloidal Systems	ii, 396
ZSIGMONDY (RICHARD). Nature of so-called Colloidal Metallic Solutions	ii, 397
SCHIRMERSEN (KARL). Representation of the Periodic System of the Elements	ii, 397
HULETT (GEORGE AUG.). Calibration of Glass Tubes, and some Compressibility Experiments	ii, 397

Inorganic Chemistry.

PAGE

PERMAN (EDGAR P.) and G. A. S. ATKINSON. Vapour Density of Bromine at High Temperatures	ii, 398
WINKLER (CLEMENS [ALEXANDER]). Preparation of Hydrogen Sulphide and its Solution	ii, 398
PÉCHARD (E.). Combination of Metallic Iodides with Sulphur Dioxide	ii, 398
WEINLAND (RUDOLPH F.) and H. PRAUSE. Compounds of Telluric acid with the Iodates	ii, 399
CHATTAWAY (FREDERICK D.) and KENNEDY J. P. ORTON. Preparation and Properties of so-called Nitrogen Iodide	ii, 399
CHATTAWAY (FREDERICK D.) and HENRY P. STEVENS. Action of Reducing Agents on Nitrogen Iodide	ii, 399
SPRINGER (EDM.). Preparation of Phosphorus Trisulphide	ii, 399
WOHLWILL (HEINRICH). Electrolysis of Solutions of Alkali Chlorides	ii, 400
FOERSTER (FRITZ). Electrolysis of Solutions of Alkali Chlorides	ii, 400
OTTINGEN (HELMUTH VON). Decomposition of Sodium Thiosulphate by acids	ii, 400
PAWLEWSKI (BRONISLAW). Solubility of Sodium Tungstate in Water, and the Density and Refractive Indices of its Solutions	ii, 400
ECKARDT (MORITZ). Change of Volume accompanying Fusion of Rubidium	ii, 400
SARGHEL (JON). Electrolysis of the Bromides of the Alkaline Earth Metals	ii, 400
FORCRAND (ROBERT DE). Hydrated Calcium Peroxides	ii, 401
LENGYEL (BÉLA VON). Radio-active Barium	ii, 402
MAWROW (F.). Action of Chlorine on Cupric Hydroxide suspended in Potassium Hydroxide	ii, 402
FONZES-DIACON (HENRI). Lead Selenides and Chloroselenides	ii, 402
ELJK (C. VAN). Formation and Transformation of the Double salts of Thallium and Silver Nitrates	ii, 403
WITT (OTTO N.) and WALTER THEEL. The Cerite Earths	ii, 403
POZZI-ESCOT (M. E.) and H. C. COUQUET. Microchemical Researches on Yttrium, Erbium, and Didymium	ii, 404
DEMARÇAY (EUGÈNE [ANATOLE]). Samarium	ii, 404
NORDEN (KONRAD). Nature of the Process which occurs at the Aluminium Electrode	ii, 404
FONZES-DIACON (HENRI). Preparation of Aluminium [Sulphide, Selenide, Phosphide, and Arsenide]	ii, 405
MOISSAN (HENRI) and VENTURI. Manganous Fluoride	ii, 405
MORSE (HARMON N.) and H. G. BYERS. Cause of the Evolution of Oxygen when Oxidisable Gases are absorbed by Permanganic acid	ii, 406
RICHARDS (THEODORE W.) and GREGORY P. BAXTER. Revision of the Atomic Weight of Iron	ii, 407
CAMPBELL (EDWARD D.). Thermochemistry of Steel and Iron	ii, 407
DUMAS (L.). Allotropic Transformations of Iron and Nickel Alloys	ii, 408
COWPER-COLES (SHERRARD). Electro-deposition of Chromium	ii, 408
COHEN (ERNST). Enantiotropy of Tin. IV.	ii, 408
KOHLRAUSCH (FRIEDRICH). Hydrolysis of some Chlorine compounds of Platinum, Gold, and Tin on standing, and under the influence of Light	ii, 408

Mineralogical Chemistry.

POPE (FREDERICK J.). Magnetic Iron Ores from Eastern Ontario	ii, 409
FLINK (GUSTAV). Minerals from Narsarsuk, S. Greenland	ii, 410
WINTHER (CHR.). Britholite, a new Mineral	ii, 413
BOGGILD (O. B.). Steenstrupine	ii, 413
WINTHER (CHR.). Schizolite, a new Mineral	ii, 413

	PAGE
CLARKE (FRANK W.) and GEORGE STEIGER. Action of Ammonium Chloride on Natrolite, Scolecite, Prehnite, and Pectolite	ii, 414
BOEGGILD (O. B.). Epistolite, a new Mineral	ii, 414
BOSCÁ Y CASANOVES (EDUARDO). Meteorite from Quesá, Spain	ii, 415
COHEN (EMIL WILHELM). Meteoric Iron from Quesá, Spain	ii, 415
PARMENTIER (F.) and A. HUBION. Gases evolved by the Springs of Mont Dore	ii, 415
NASINI (RAFFAELE) and ROBERTO SALVADORI. Combustible Gases of Salsomaggiore	ii, 415

Physiological Chemistry.

HALDANE (JOHN S.) and J. LORRAIN SMITH. The percentage Oxygen Capacity and total Oxygen Capacity and the total mass of Blood in Man	ii, 416
SMITH (J. LORRAIN). The Volume, total Oxygen Capacity, and percentage Oxygen Capacity of the Blood in Chlorosis and Pernicious Anæmia	ii, 416
ABDERHALDEN (EMIL). Relationship of Iron to Blood-formation	ii, 416
NIOLOUX (MAURICE). Effect of Ingestion of Alcohol on the Blood of Mother and Fœtus and on the Milk	ii, 416
RUMPF (THEODOR) and O. SCHUMM. Chemical changes in the Blood produced by feeding with Ammonium Sulphate	ii, 417
DAWSON (PERCY M.). Hæmorrhage and Transfusion in Dogs	ii, 417
BARCROFT (JOSEPH). Gaseous Metabolism of the Submaxillary Gland	ii, 417
KELLNER (OSCAR), A. KÖHLER, F. BARNSTEIN, W. ZIELSTORFF, R. EWERT, and K. WEDEMEYER. Influence of Asparagine and Ammonia on Protein Metabolism in Ruminants	ii, 417
LOEWI (OTTO). Nuclein Metabolism	ii, 417
PFLÜGER (EDUARD (FRIEDRICH WILHELM)). Energy-value of Flesh and Protein	ii, 417
SCHAEFFER (J. C. TH.). Influence of Alcohol on muscular work	ii, 418
BOUCHARD (CHARLES) and ALEXANDRE DESGREZ. Transformation of Fat into Glycogen	ii, 418
MUNK (IMMANUEL). Action of Soaps in the Body	ii, 418
HAMBURGER (HARTOG JAKOB). Absorption of Fats and Soaps in the large Intestine	ii, 418
HUGOUNENQ (LOUIS). Fixation of Alkaline Bases in the Fœtal Body during the last Five Months of Intrauterine Life	ii, 418
GALLARD (F.). Absorption of Iodides by the Skin	ii, 419
CHARBIN (ALBERT) and BOURGET. Variations in the Iodine of the Thyroid of New-born Children under various Pathological Conditions	ii, 419
OSBORNE (W. A.). Hüfner's method of preparing pure Glycocholic acid	ii, 419
PARKER (F. H.) and GRAHAM LUSK. The maximum production of Hippuric acid in Rabbits	ii, 419
KOBRAK (ERWIN). Caseinogen of Human Milk	ii, 420
PIERALLINI (G.). Glycolytic action of the Pancreas and of Urine	ii, 420
HAMBURGER (HARTOG JAKOB). Lipolytic Ferment in Human Ascitic Fluid	ii, 420
MÜLLER (JOHANNES) and A. MASUYAMA. A Diastatic Ferment in Hen's Eggs	ii, 420
GULEWITSCH (WLADIMIR VON). Meningocele Fluid	ii, 420
COUPIN (HENRI). The Crystalline Stalk of Cephalous Molluscs	ii, 420
KOSSEL (ALBRECHT) and GOTO. Solution of Uric acid by means of Nucleic acid	ii, 421
HAMBURGER (HARTOG JAKOB). Investigation of Urine by a combination of the Freezing Point and Blood Corpuscle methods	ii, 421
MAYER (PAUL) and CARL NEUBERG. Glycuronic acid in Normal Urine	ii, 421
SHERMAN (H. C.) and P. B. HAWK. Elimination of Nitrogen, Sulphates, and Phosphates, after Ingestion of Protein Food	ii, 421

	PAGE
HABNAOK (ERICH) and ELSE VON DER LEYEN. Indicanuria produced by administration of Oxalates	ii, 422
MICKO (KARL). Comparative investigation of the Fæces after feeding on Meat and Plasmon	ii, 422
MÜLLER (PAUL). Organic Phosphorus in Fæces after feeding on Milk	ii, 422
SPIEGEL (LEOPOLD). Composition of Urinary Calculi	ii, 422
ROTH. Secretion of Papain in Gastric Disease	ii, 422
STEJSKAL (C. VON) and F. ERBEN. Metabolism in Leucæmia	ii, 423
HALLIBURTON (WILLIAM DOBINSON). Physiological effects of Extracts of Nervous Tissues	ii, 423
OSBORNE (W. A.) and SWALE VINCENT. Physiological effects of Extracts of Nervous Tissues	ii, 423
DELEZENNE (C.). Antileucocytic Serum and its action on the Coagulation of the Blood	ii, 423
FRÄNKEL (SIGMUND). Chemical behaviour of Drugs and Poisons in the Organism	ii, 423
ELFSTRAND (MÅRTEN). Action of some Aliphatic compounds	ii, 423
FIQUET (EDMOND). Physiological action of Nitriles	ii, 424
FILEHNE (WILHELM). Action of Santonin and Amyl Nitrite on Vision	ii, 424
BOCK (JOHANNES). Action of Caffeine and Theobromine on the heart	ii, 424
ALBANESE (MANFREDI). Physiological action of 1- and 4-Methylxanthines	ii, 424
WINTERBERG (HEINRICH). Action of Nicotine on Respiration and Circulation	ii, 424
WALLER (AUGUSTUS D.). Comparative action of Veratrine Alkaloids on Muscle and Nerve	ii, 425

Chemistry of Vegetable Physiology and Agriculture.

BEIJERINCK (MARTINUS WILLEM). Production of Quinone by <i>Streptothrix chromogena</i> , and the Biology of this Microbe	ii, 425
RAAB (OSCAR). Action of Fluorescent Substances on Infusoria	ii, 425
JENNINGS (HERBERT S.). Reactions to Stimuli of Unicellular Organisms	ii, 425
HILTNER (LORENZ). Root Nodules of Alder and <i>Elaeagnus</i>	ii, 426
POLACCI (GINO). Assimilation by means of Chlorophyll	ii, 426
GRIFFON (ED.). Chlorophyllous Assimilation in Indoor Plants	ii, 426
BOKORNY (THOMAS). Occurrence of Albumin, Albumose, and Peptone in the vegetative portions of Plants	ii, 426
HOKHNEL (M.). Occurrence of Dulcitol in the Bark of <i>Econymus arthropurpureus</i>	ii, 427
PASSERINI (NAPOLEONE). Gummy Substance in Elm Galls	ii, 427
MAYER (ADOLF). Distribution of the Diastatic Enzyme in the Potato Plant	ii, 427
BRÄUTIGAM (W.). Formation of Vanillin in Potato-parings, and its detection	ii, 427
THOMS (HERMANN). Products in Tobacco Smoke	ii, 428
CURTEL (GEORGES). Experiments on the Physiological Phenomena which accompany Chlorosis in the Vine	ii, 428
ANDRÉ (GUSTAVE). Some Changes Produced in Etiolated Plants	ii, 428
SCHERPE (R.). Chemical Alteration of Rye and Wheat on becoming Mouldy	ii, 429
CAMPBELL (J. R.). Manuring of Clover Hay	ii, 429
SEISSL (JOSEF) and EMANUEL GROSS. Experiments with Horse Beans in Soils of Various Origin under the same Climatic Conditions	ii, 430
GRAFITAU (J.). Composition of the Very Rich Sugar Beet of the Season 1898	ii, 430
MILLER (NORMAN HARRY JOHN). Experiments at Rothamsted on the Changes in the Composition of Mangels During Storage	ii, 430
ULLMANN (MARTIN) and A. GRIMM. Behaviour of Water Soluble Phosphoric Acid in Soils	ii, 431
WHEELER (HENRY J.), BURT L. HARTWELL, and C. L. SARGENT. Chemical Methods for ascertaining the Lime Requirements of Soils	ii, 432

	PAGE
LECHARTIER (J.). Composition of the Soils of the Canton Redon as regards Lime, Magnesia, Potash, and Nitrogen	ii, 432
LECHARTIER (G.). Arable Soils of the Canton Redon with respect to Phosphoric Acid	ii, 433
SEMPELOWSKI (A.). Analysis of Siberian Arable Soil	ii, 433
CAMPBELL (J. R.). Use of Nitragin and Alinit for the Growth of Beans and Oats respectively	ii, 433
FRILITZEN (HJALMAR VON). Experiments with Alinit	ii, 433
TACKE (BRUNO). Alinit	ii, 434

Analytical Chemistry.

JOB (ANDRÉ). Apparatus for Measuring Evolved Gases at Constant Volume	ii, 434
BENOIT (E.). Hydro-gasometer and Urinometer	ii, 435
HOLLARD (AUGUSTE). New Electrodes for Electrolytic Estimations	ii, 435
FORMÁNEK (JULIUS). A New Indicator	ii, 435
WOLFF (JULES). New Indicator for Acidimetry: Estimation of Boric acid	ii, 435
MASSON (DAVID ORME). Iceland Spar as a Standard in Volumetric Analysis	ii, 436
ABEGG (RICHARD) and W. HERZ. Separation and Identification of acids	ii, 436
WESZELSZKY (JULIUS VON). Volumetric Estimation of Bromides in presence of Iodides and Chlorides	ii, 436
TECLU (NICOLAE). Estimation of Ozone	ii, 437
DOBBIN (LEONARD). Detection of Sulphites in presence of Thiosulphates	ii, 437
DAVIDSON (C.). Estimation of Nitric Nitrogen by Schloësing's Method	ii, 437
MENNICKE (H.). Detection of Nitrous Acid in Water by means of Amino-naphthol-K-acid [1-Amino-8-hydroxynaphthalene-4:6-disulphonic acid]	ii, 438
UTZ (F.). Detection of Nitric Acid in Water and in Milk	ii, 438
SCHAEER (EDUARD). Hygienic Significance of Nitrites in Drinking Water	ii, 438
KÖNIG ([FRANZ] JOSEF). Connection between the Chlorides and Nitrates in Polluted Well Waters in Inhabited Localities	ii, 438
HOLLARD (AUGUSTE) and L. BERTIAUX. Estimation of Arsenic in Metals and Alloys	ii, 438
BORNTÄGER (HUGO). Detection of Boric acid in Borates	ii, 439
BENEDICT (FRANCIS GANO). Absorption Apparatus for Elementary Organic Analysis	ii, 439
MABERY (CHARLES F.) and WILLIAM R. CLYMER. Estimation of Carbon and Hydrogen by Combustion in Oxygen using Copper Oxide	ii, 439
BENEDICT (FRANCIS GANO). Elementary Analysis of Organic Substances containing Nitrogen	ii, 439
SARGENT (GEORGE WILLIAM). Repeated use of Copper Potassium Chloride for the Solution of Steel or Iron in Estimating Carbon	ii, 440
BREARLEY (HARRY). Direct Combustion of Metallic Alloys	ii, 440
RICHARDS (JOSEPH W.) and NORMAN S. POWELL. Substitutes for Hydrochloric acid in Testing for Carbonates	ii, 440
LOW (ALBERT) H. Technical Estimation of Zinc	ii, 441
TOCHER (JAMES F.). Volumetric Estimation of Red Lead	ii, 442
THOMAS (VICTOR). Estimation of Thallium	ii, 442
HOLLARD (AUGUSTE). Analysis of Commercial Copper	ii, 442
LEHMANN (MARTIN). Volumetric Estimation of Corrosive Sublimate in Dressing Materials	ii, 443
BÖTTGER (WILHELM). Estimation of Manganese as Pyrophosphate	ii, 443
PATTINSON (JOHN) and HUGH S. PATTINSON. Estimation of Manganese as Sulphide	ii, 443
HIORNS (ARTHUR). Electrolytic Estimation of Manganese in Manganese Ores	ii, 444
JERVIS (HORACE). Estimation of Manganese in Steel	ii, 444
RIDENOUR (W. E.). Soluble Ferric Pyrophosphate	ii, 444
BORNTÄGER (HUGO). Analysis of Molybdenum Alloys	ii, 444
IBBOTSON (FRED) and HARRY BREARLEY. Separation of Tungsten and Molybdenum	ii, 445

	PAGE
ROGERS (ALLEN). Tests for Tin	ii, 445
DÖRING (THEODOR). Detection of small quantities of Gold in Ores	ii, 445
HALPHEN (GEORGES). Detection of Benzene in denatured Alcohol	ii, 446
PARIS (GIULIO). Hunderträuter-Likör (Centerba)	ii, 446
STRUVE (HEINRICH). Some Properties of Glycerol	ii, 446
SULEIMAN BEY. [Estimation of Pentoses in Urine]	ii, 446
LEONARD (NORMAN). Analysis Golden Syrup	ii, 447
JONES (EDWARD WILLIAM TAYLOR). Treacle or Golden Syrup	ii, 447
MATTHEWS (CHARLES G.) and A. HYDE PARKER. Analysis of a sample of Treacle and of so-called Golden Syrup	ii, 448
KÖNIG ([FRANZ] JOSEF). The unrestricted use of Starch Syrup in Articles of Food	ii, 448
BECK (CARL). Estimation of Cellulose	ii, 448
KÖNIG ([FRANZ] JOSEF). Estimation of Cellulose	ii, 449
SCHOEBL (N.). Isolation and Separation of the chief Organic acids	ii, 449
SPARRE (FIN). Estimation of Formic acid in presence of Acetic acid	ii, 449
DOOLITTLE (H. E.) and WILLIAM H. HESS. Cider Vinegar; its Solids and Ash	ii, 450
JOLLES (ADOLF). Estimation of Uric acid in Urine	ii, 450
LINDET (LÉON). Estimation of Fat in Dairy Products	ii, 450
RICHMOND (H. DROOP) and J. BRISTOWE P. HARRISON. Sour Milk	ii, 451
LEACH (ALBERT E.). Foreign Colouring Matter in Milk	ii, 451
ESTCOURT (CHARLES). Butters from various Countries compared	ii, 452
HESS (WILLIAM H.) and E. E. DOOLITTLE. Detection of "Process" or "Renovated" Butter	ii, 452
PILHASY (BENJAMIN M.). Comparison of some Tests for Formaldehyde	ii, 453
AMTHOR (CARL). Two Deceptive Reactions	ii, 453
RIMINI (ENRICO). Colour Reaction of Acetaldehyde. II.	ii, 454
MAUCH (RICHARD). Physico-chemical Properties of Chloral Hydrate and their Applications to Pharmacology	ii, 454
STOCKÉ (A.). Vanillin in Wine Vinegar	ii, 454
LABBÉ (HENRI). [Estimation of Carvone in Essential Oils]	ii, 454
JOLLES (ADOLF). Quantitative Reaction of Ureides and Purine derivatives	ii, 454
THOMS (HERMANN). [Estimation of Nicotine in Cigars]	ii, 455
HILL (J. RUTHERFORD). Strychnine salts and Chloroform	ii, 455
SCHAEER (EDUARD). Action of Chloroform and similar Solvents on Alkaloid salts	ii, 455
BETHIEN (ADOLF), PAUL BORISCH, and JOSEPH DEITER. Examination of Tea	ii, 455
RAIKOW (P. N.) and P. SCHTARBANOW. Testing Antipyrine for Antifebrin, Phenacetin, and Exalgin	ii, 456
PAESSLER. Analysis of Tannin Materials	ii, 457
LEENT (FREDERIK HENDRIK VAN). Distinction of Indigo from other Blue Dyes on Fabrics	ii, 457
SPIEGEL and PERITZ. Rosin's Method for the determination of the Reducing Power of Urine, &c.	ii, 457
CAUSSE (HENRI [EUGÈNE]). Cystine in Impure Well Waters in the neighbourhood of Lyons	ii, 457
CAUSSE (HENRI [EUGÈNE]). Detection and Estimation of Cystine and its variation in amount in Contaminated Water	ii, 458
CAUSSE (HENRI [EUGÈNE]). Presence of Trypsine in contaminated Well Water	ii, 458
HALDANE (JOHN SCOTT). The Ferricyanide Method of Determining the Oxygen capacity of Blood	ii, 458
HÜFNER (GUSTAV). Simultaneous Estimation of two Colouring Matters in Blood by the Spectrophotometer	ii, 459
BÜLOW (KARL). Estimation of Absorbable Proteids in Foods	ii, 459
MANKIEWICZ. Sulphosalicylic acid as a Test for Albumin in Urine	ii, 459
JUCKENACK (ADOLF). Examination and Valuation of Commercial Pastry	ii, 460
BEHN (SIGISMUND). Examination of Commercial Pastry	ii, 460

INDEX OF AUTHORS' NAMES.

A.

Abderhalden, E., ii, 416.
 Abegg, R., and W. Herz, ii, 436.
 Albanese, M., ii, 424.
 Albert, R., and E. Buchner, i, 420.
 Amthor, C., ii, 453.
 André, G., ii, 428.
 Ausel, O. See H. von Pechmann.
 Aschan, O., i, 399.
 Aston, W. G. See J. T. Hewitt.
 Astre, C. See J. Ville.
 Atkinson, G. A. S. See E. P. Permann.
 Auwers, K., i, 418.

B.

Barcroft, J., ii, 417.
 Barnstein, F. See O. Kellner.
 Baud, E., i, 369.
 Baudran, G., i, 375.
 Bauer, P. See M. Busch.
 Baxter, G. P. See T. W. Richards.
 Bayley, T., i, 369.
 Beck, C., ii, 448.
 Becquerel, H., ii, 381.
 Beijerinck, M. W., i, 403 ; ii, 425.
 Bein, S., ii, 460.
 Benedict, F. G., ii, 439.
 Benoit, E., ii, 435.
 Berthelot, M., ii, 387.
 Bertiaux, L. See A. Hollard.
 Bertram, J., and J. Helle, i, 398.
 Bertrand, G., i, 377.
 Beythien, A., P. Borisch, and J. Deiter, ii, 455.
 Bignami, C., and G. Testoni, i, 400.
 Binz, A., and A. Hagenbach, ii, 384.
 Binz, A. See also L. Preuss.
 Bischoff, C. A., i, 392, 393, 394, 395, 396.
 Blackman, W. L. See K. J. P. Orton.
 Bock, J., ii, 424.
 Boeggild, O. B., ii, 413, 414.

Böttger, W., ii, 443.
 Bogert, M. T., and A. H. Gotthelf, i, 412.
 Bokorny, T., ii, 426.
 Borisch, P. See A. Beythien.
 Bornträger, H., ii, 439, 444.
 Borsch, W. See K. A. Hofmann.
 Borsche, W., i, 419.
 Bosca, Y Casanoves, E., ii, 415.
 Bouchard, C., and A. Desgrez, ii, 418.
 Bourcet. See A. Charrin.
 Bräutigam, W., ii, 427.
 Brearley, H., ii, 440.
 Brearley, H. See also F. Ibbotson.
 Buchner, E. See R. Albert.
 Bülow, K., ii, 459.
 Busch, M., and P. Bauer, i, 414.
 Busch, M., and E. Lingenbrink, i, 411, 413.
 Byers, H. G. See H. N. Morsa.

C.

Cajola, A., and A. Cappellini, ii, 394.
 Cameron, F. K. See W. H. Krug.
 Campbell, E. D., ii, 407.
 Campbell, J. R., ii, 439, 433.
 Cappellini, A. See A. Cajola.
 Caubet, F., ii, 390.
 Causse, H., ii, 457, 458.
 Charrin, A., and Bourcet, ii, 419.
 Chattaway, F. D., and K. J. P. Orton, TRANS., 789, 797 ; ii, 399.
 Chattaway, F. D., K. J. P. Orton, and W. H. Hurlley, TRANS., 800.
 Chattaway, F. D., and H. P. Stevens, ii, 399.
 Claisen, L., and E. Haase, i, 373.
 Clarke, F. W., and G. Steiger, ii, 414.
 Clemen, J. See R. Walther.
 Clymer, W. R. See C. F. Mabery.
 Cohen, E., ii, 381, 408.
 Cohen, E. W., ii, 415.
 Cohn, R. See A. Rosenheim.

Coupin, H., ii, 420.
 Cowper-Coles, S., ii, 408.
 Curtel, G., ii, 428.

D.

Dains, F. B., i, 390.
 Davidson, C., ii, 437.
 Dawson, H. M., and P. Williams,
 ii, 383.
 Dawson, P. M., ii, 417.
 Delter, J. See A. Beythien.
 Delange, R. See C. Mouren.
 Delezenne, C., ii, 423.
 Demarçay, E. A., ii, 404.
 Desgrez, A. See C. Bouchard.
 Dobbie, J. J. See W. N. Hartley.
 Dobbins, L., ii, 437.
 Döring, T., ii, 445.
 Donnan, F. G., ii, 390.
 Doolittle, R. E., and W. H. Hess,
 ii, 450.
 Doolittle, R. E. See also W. H. Hess.
 Dootson, F. W. See W. J. Sell.
 Dreyfus, W. E. See A. Hilger.
 Dumas, L., ii, 408.

E.

Eckardt, M., ii, 400.
 Eichwald, E. See K. A. Hofmann.
 Eijk, C. van, ii, 403.
 Elfstrand, M., ii, 423.
 Engels, O., i, 406.
 Engler, C., i, 399.
 English, E., ii, 381.
 Erben, F. See V. Stejskal.
 Estcourt, C., ii, 452.
 Ettlinger, J. See R. Fosse.
 Ewert, R. See O. Kellner.

F.

Feilitzen, H. von, ii, 433.
 Ferretto, L., ii, 386.
 Filehne, W., ii, 424.
 Fiquet, M. E., ii, 424.
 Fischer, E., i, 417.
 Fischer, R. See W. McPherson.
 Fittig, R., i, 375, 397.
 Flink, G., ii, 410.
 Foerster, F., ii, 400.
 Fonze-Diacon, H., ii, 402, 405.
 Forerand, R. de, ii, 401.
 Formánek, J., ii, 435.
 Fosse, R., and J. Ettlinger, i, 392.
 Fränkel, S., ii, 423.

Franklin, E. C., and C. A. Kraus,
 ii, 382.
 Fromm, E., i, 402.

G.

Gabutti, E., i, 370.
 Gahl, R., ii, 339.
 Gallard, F., ii, 419.
 Geiger, M., ii, 394.
 Goldschmidt, H., and L. Osan,
 i, 373.
 Goto. See A. Kossel.
 Gotthelf, A. H. See M. T. Bogert.
 Graftian, J., ii, 430.
 Gray, T., i, 376.
 Griffon, E., ii, 426.
 Grignard, V., i, 382.
 Grimm, A. See M. Ullmann.
 Gross, E. See J. Seissl.
 Guerbet, M., i, 401.
 Gulewitsch, W. von, ii, 420.

H.

Haase, E. See L. Claisen.
 Hagenbach, A. See A. Binz.
 Haldane, J. S., ii, 458.
 Haldane, J. S., and J. L. Smith, ii, 416.
 Haller, A., i, 372.
 Halliburton, W. D., ii, 423.
 Halphen, G., ii, 446.
 Hamburger, H. J., ii, 418, 420, 421.
 Hardin, D., i, 412.
 Hardy, W. B., ii, 396.
 Harlay, V., i, 419, 420.
 Harnack, E., and E. von der Leyen,
 ii, 422.
 Harries, C. D., and E. Klamt, i, 413.
 Harrison, J. B. See H. D. Richmond.
 Hartley, W. N., and J. J. Dobbie,
 TRANS., 346.
 Hartley, W. N., J. J. Dobbie, and
 P. G. Paliatseas, TRANS., 339.
 Hartwell, B. L. See H. J. Wheeler.
 Hasselberg, H., ii, 381.
 Hawk, P. B. See H. C. Sherman.
 Hazewinkel, J. J., i, 403.
 Helfenstein, A., ii, 383.
 Helle, J. See J. Bertram.
 Herz, W. See R. Abegg.
 Hess, W. H., and R. E. Doolittle,
 ii, 452.
 Hess, W. H. See also H. E. Doolittle.
 Hewitt, J. T., and W. G. Aston,
 TRANS., 310.
 Hilger, A., and W. E. Dreyfus, i, 379.

Hill, H. B., i, 392.
 Hill, J. R., ii, 455.
 Hiltner, L., ii, 426.
 Hiorns, A., ii, 444.
 Hirsch, R. von, ii, 388.
 Hoehnel, M., ii, 427.
 Hofmann, K. A., W. Borsch, E. Eichwald, and J. Sand, i, 383.
 Hofmann, K. A., and J. Sand, i, 384.
 Hofmann, K. A. See also J. Sand.
 Hollard, A., ii, 435, 442.
 Hollard, A., and L. Bertiaux, ii, 438.
 Holleman, A. F., i, 387.
 Hoogewerff, S., and H. ter Meulen, i, 404.
 Howles, F. H., J. F. Thorpe, W. Udall, and, in part, H. A. Neale, TRANS., 942.
 Hüfner, G., ii, 459.
 Hugounenq, L., ii, 418.
 Hulet, G. A., ii, 397.
 Hurion, A. See F. Parmentier.
 Hurtley, W. H. See F. D. Chattaway.

I.

Ibbotson, F., and H. Brearley, ii, 455.
 Iglauer, F. See R. Willstätter.
 Ikeda, K., ii, 386, 391.

J.

Jennings, H. S., ii, 425.
 Jervis, H., ii, 444.
 Job, A., ii, 434.
 Jolles, A., ii, 450, 454.
 Jones, E. W. T., ii, 447.
 Jowett, H. A. D., TRANS., 851.
 Juckenaek, A., ii, 460.
 Junghahn, A., i, 389.
 Junghahn, A., and M. Neumann, i, 418.

K.

Kellner, O., A. Köhler, F. Barnstein, W. Zielstorff, R. Ewart, and K. Wedemeyer, ii, 417.
 Kipping, F. S., TRANS., 861.
 Klages, A., and C. Lieke, i, 387.
 Klamt, E. See C. D. Harries.
 Klobb, T., i, 405.
 Knorr, L., i, 376.
 Kobrak, E., ii, 420.
 Köhler, A. See O. Kellner.
 Koelichen, K., ii, 395.
 König, J., ii, 438, 448, 449.
 Kötze, A., i, 369.

Kohlrausch, F., ii, 408.
 Kossel, A., and Goto, ii, 421.
 Kraus, C. A. See E. C. Franklin.
 Krug, W. H., and F. K. Cameron ii, 393.

L.

Labbé, H., i, 398.
 Lachman, A., i, 380.
 Ladenburg, A., and K. Scholtze, i, 409.
 Leach, A. E., ii, 451.
 Lechartier, J., ii, 432, 433.
 Leent, F. H. van, ii, 457.
 Lehmann, M., ii, 443.
 Lengyel, B. von, ii, 402.
 Lenher, V., i, 379.
 Leonard, N., ii, 447.
 Lewin, J. See A. Pinner.
 Ley, H., i, 382.
 Leyen, E. von der. See E. Har-nack.
 Liecke, C. See A. Klages.
 Lincoln, A. T., ii, 392.
 Lindet, L., ii, 450.
 Lingenbrinck, E. See M. Busch.
 Loewi, O., ii, 417.
 Low, A. H., ii, 441.
 Lowry, T. M., and J. H. West, TRANS., 950.
 Lusk, G. See F. H. Parker.

M.

Mabery, C. F., and W. R. Clymer, ii, 439.
 McCoy, H., ii, 387.
 McPherson, W., and R. Fischer, i, 411.
 Mankiewicz, ii, 459.
 March, F., i, 374.
 Marchlewski, L., i, 404.
 Marckwald, W., i, 391.
 Massol, G., ii, 386.
 Masson, O., ii, 436.
 Matthews, C. G., and A. H. Parker, ii, 448.
 Mauch, R., ii, 454.
 Mawrow, F., ii, 402.
 Mayer, A., ii, 427.
 Mayer, P., and C. Neuberg, ii, 421.
 Mayusama, A. See J. Müller.
 Mennicke, H., ii, 438.
 Meulen, H. ter. See S. Hoogewerff.
 Meyer, S., ii, 386.
 Micko, C., ii, 422.
 Miller, N. H. J., ii, 430.
 Milner, S. R., ii, 385.
 Minozzi, A., i, 406.

Miolati, A., i, 381.
 Mohr, E., i, 409.
 Moissan, H., and Venturi, ii, 405.
 Mollinari, E., i, 374.
 Moore, T. S., ii, 381.
 Morello, A., ii, 395.
 Morgan, G. T., TRANS., 814.
 Morse, H. N., and H. G. Byers, ii, 406.
 Moureu, C., and R. Delange, i, 397.
 Müller, J., and A. Mayusama, ii, 420.
 Müller, P., ii, 422.
 Munk, I., ii, 418.

N.

Nasini, R., and R. Salvadori, ii, 415.
 Neale, H. A. See F. H. Howles.
 Neuberg, C., i, 410.
 Neuberg, C. See also P. Mayer.
 Neumann, M. See A. Junghahn.
 Newth, G. S., TRANS., 775.
 Nicloux, M., ii, 416.
 Nörr, W. See R. Scholl.
 Norden, K., ii, 404.

O.

Oechsner de Coninck, W., i, 378.
 Oettingen, H. von, ii, 400.
 Orton, K. J. P., and W. L. Blackman, TRANS., 830.
 Orton, K. J. P. See also F. D. Chattaway.
 Osborne, W. A., ii, 419.
 Osborne, W. A., and S. Vincent, ii, 423.
 Oslan, L. See H. Goldschmidt.

P.

Paessler, ii, 457.
 Paliatseas, P. G. See W. N. Hartley.
 Paris, G., ii, 446.
 Parker, A. H. See C. G. Matthews.
 Parker, F. H., and G. Lusk, ii, 419.
 Parmentier, F., and A. Hurion, ii, 415.
 Passerini, N., ii, 427.
 Pattinson, J. and H. S., ii, 443.
 Pawlowski, B., ii, 400.
 Péchard, E., ii, 398.
 Pechmann, H. von, and O. Ansel, i, 389.
 Peritz. See Spiegel.
 Perman, E. P., and G. A. S. Atkinson, ii, 398.
 Pflüger, E., ii, 417.

Pierallini, G., ii, 420.
 Pilhashy, B. M., ii, 453.
 Pinner, A., i, 409.
 Pinner, A., and J. Lewin, i, 409.
 Polacci, G., ii, 426.
 Ponsot, A., ii, 392.
 Pope, F. J., ii, 409.
 Pouret, C., i, 369.
 Powell, N. S. See J. W. Richards.
 Pozzi-Escot, M. E., ii, 404.
 Prause, H. See R. F. Weinland.
 Preuss, L., and A. Binz, i, 392.
 Prunier, L., i, 376.

R.

Raab, O., ii, 425.
 Raikow, P. N., and P. Schtarbanow, ii, 456.
 Reynolds, J. E., TRANS., 836.
 Richards, J. W., and N. S. Powell, ii, 440.
 Richards, T. W., ii, 391.
 Richards, T. W., and G. P. Baxter, ii, 407.
 Richmond, H. D., and J. B. P. Harrison, ii, 451.
 Ridenour, W. E., ii, 444.
 Rimini, E., ii, 454.
 Ris, C., i, 419.
 Rogers, A., ii, 445.
 Rosenheim, A., and R. Cohn, i, 381.
 Roth, ii, 422.
 Ruhemann, S., and H. E. Stapleton, TRANS., 804.
 Rumpff, T., and O. Schumm, ii, 417.
 Rupe, H., i, 371.
 Rydberg, J. R., ii, 392.

S.

Salvadori, R. See R. Nasini.
 Sand, J., and K. A. Hofmann, i, 385, 386.
 Sand, J. See K. A. Hofmann.
 Sargent, C. L. See H. J. Wheeler.
 Sargent, G. W., ii, 440.
 Sarghel, J., ii, 400.
 Schaer, E., ii, 438, 455.
 Scheffer, J. C. T., ii, 418.
 Scherpe, R., ii, 429.
 Schirmelsen, K., ii, 397.
 Schlossberg, G., i, 376.
 Schönrock, O., i, 378.
 Scholl, R., and W. Nörr, i, 386.
 Scholtze, K. See A. Ladenburg.
 Schoorl, N., ii, 449.
 Schreinmakers, F. A. H., ii, 393.
 Schtarbanow, P. See P. N. Raikow.

Schumm, O. See T. Rumpff.
 Seissl, J., and E. Gross, ii, 430.
 Sell, W. J., and F. W. Dootson,
 TRANS., 771.
 Sempelowski, A., ii, 433.
 Sherman, H. C., and P. B. Hawk,
 ii, 421.
 Smith, J. L., ii, 416.
 Smith, J. L. See also J. S. Haldana.
 Smith, R. H., and B. Tollens, i, 378.
 Smits, A., ii, 388, 389.
 Snape, H. L., TRANS. 778.
 Soden, H. von, i, 401.
 Sommer, F., i, 388.
 Sparre, F., ii, 449.
 Spiegel, L., ii, 422.
 Spiegel and Peritz, ii, 456.
 Springer, E., ii, 399.
 Stapleton, H. E. See S. Ruhemann.
 Steiger, G. See F. W. Olarka.
 Stejskal, V. von, and F. Erben, ii, 423.
 Stevens, H. P. See F. D. Chattaway.
 Stocky, A., ii, 454.
 Struve, H., ii, 446.
 Sulc, O., ii, 395.
 Suleiman Bey, i, 377; ii, 446.

T.

Tacke, Bruno, ii, 434.
 Teclu, N., ii, 437.
 Testoni, G. See C. Bignami.
 Theel, W. See O. N. Witt.
 Thomas, V., ii, 442.
 Thoma, H., ii, 428.
 Thorpe, J. F., TRANS., 923.
 Thorpe, J. F., and W. J. Young,
 TRANS., 936.
 Thorpe, J. F. See also F. H. Howles.
 Tocher, J. F., ii, 442.
 Tollens, B. See R. H. Smith.
 Touren, C., ii, 396.
 Traube, W., i, 416.
 Traube, W., and E. von Wedelstadt,
 i, 389.

U.

Udall, W. See F. H. Howles.

Uhlfelder, E. See L. Vanino.
 Ullmann, M., and A. Grimm, ii, 431.
 Utz, F., ii, 438.

V.

Vanino, L., and E. Uhlfelder, i, 371.
 Venturi. See H. Moissan.
 Villard, P., ii, 381.
 Ville, J., and C. Astre, i, 411.
 Vincent, S. See W. A. Osborne.

W.

Waller, A. D., ii, 425.
 Walther, R. von, and J. Clemen,
 i, 408.
 Wedelstädt, E. von. See W. Traube.
 Wedemeyer, K. See O. Kellner.
 Weinland, R. F., and H. Prause,
 ii, 399.
 West, J. H. See T. M. Lowry.
 Weszelszky, J. von, ii, 436.
 Wheeler, H. J., B. L. Hartwell, and
 C. L. Sargent, ii, 432.
 Whetham, W. O. D., ii, 390.
 Williams, P. See H. M. Dawson.
 Willstätter, R., i, 404, 405.
 Willstätter, R. and F. Iglauder,
 i, 404.
 Winkler, C., ii, 398.
 Winterberg, H., ii, 424.
 Winther, C., ii, 418.
 Witt, O. N., and W. Theel, ii, 403.
 Wohlwill, H., ii, 400.
 Wolf, C. G. L., ii, 382.
 Wolff, J., ii, 435.

Y.

Young, W. J. See J. F. Thorpe.

Z.

Zielstorff, W. See O. Kellner.
 Zsigmondy, R., ii, 397.

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VOL. LXXVI. (ABSTR., 1899).

PART I.

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CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
LXXXIV.—The Persulphuric Acids. By T. MARTIN LOWRY, D.Sc., and JOHN H. WEST (<i>Continued</i>)	961
LXXXV.—Dimethyldiacetylacetone, Tetramethylpyrone, and Orcinol Derivatives from Diacetylacetone. By J. N. COLLIE, F.R.S., and B. D. STEELE, B.Sc. (Melbourne), 1851 Exhibition Scholar	961
LXXXVI.—Dehydracetic Acid. By J. N. COLLIE, F.R.S.	971
LXXXVII.—Decomposition of Hydroxyamidodisulphates by Copper Sulphate. By EDWARD DIVERS and TAMEMASA HAGA	978
LXXXVIII.—Condensation of Phenols with Esters of the Acetylene Series. Part I. Action of Phenols on Ethyl Phenylpropionate. By SIEGFRIED RUHEMANN and FRED. BEDDOW, D.Sc., Ph.D.	984
LXXXIX.—Estimation of Furfuraldehyde. By WILLIAM CORMACK	990
Friedel Memorial Lecture. By J. M. CRAFTS, Professor	993
XC.—Diphenyl- and Dialphyl-ethylenediamines, and their Nitro-derivatives, Nitrates, and Mercurichlorides. By WILLIAM SLOAN MILLS, B.A., Demonstrator of Chemistry in the Queen's College, Galway	1020
XCI.—Researches on Morphine. Part I. By S. B. SCHRYVER and FREDERIC H. LEES	1024
XCII.—The Oxime of Mesoxamide and some Allied Compounds. By MARTHA ANNIE WHITELEY, B.Sc.	1040
XCIII.—Phenylacetylchloramine and its Analogues. By HENRY E. ARMSTRONG	1047
XCIV.—Derivatives of Cyanocamphor and of Homocamphoric Acid. By ARTHUR LAPWORTH	1053
XCV.—Asymmetric Optically Active Sulphur Compounds. <i>d</i> -Methylethylthetine Platinichloride. By WILLIAM JACKSON POPE and STANLEY JOHN PEACHEY	1072

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

	PAGE
PETRENKO-KRITSCHENKO (PAVEL IW.). Configuration of Saturated Fatty compounds	i, 421
SABATIER (PAUL) and JEAN B. SENDERENS. Hydrogenation of Acetylene in Presence of Copper	i, 421
WITTORF (NICOLAUS M.). Addition of Hypochlorous and Hypobromous acids to Acetylene and to its Monosubstituted derivatives	i, 421
LUBARSKY (EUGÈNE). Hydrocarbon, C_8H_{10} from Dimethylallylcarbinol	i, 422
WOLKOFF (ALESEI A.) and BORIS N. MENSCHUTKIN. Action of Zinc Dust on Trimethylene Bromide	i, 423
CHARON (ERNEST) and PAIX-SÉAILLES. Glycol Monoiodohydrin	i, 423
MAQUENNE (LÉON). Partial Synthesis of <i>l</i> -Erythritol	i, 423
BERTRAND (GABRIEL). Reduction of Erythrulose and Preparation of a New Erythritol; <i>d</i> -Erythritol	i, 424
ZEHENTER (JOSEF). Behaviour of Uranyl Acetate and some of its Double salts towards Water	i, 424
BIILMANN (EINAR) and ALFRED WÖHLK. Methods for the Preparation of Acrylic acid	i, 425
WÖHLK (ALFRED). Acrylic acid from Glycerol	i, 425
BIILMANN (EINAR). Preparation of Acrylic acid from Allyl alcohol	i, 425
LESPIEAU (ROBERT). γ -Chlorocrotonic acid	i, 425
KASANSKY (ALEXANDER). Action of Hydrogen Bromide on Ricinoleic acid and on its Acetyl derivatives	i, 426
FICHTER (FRITZ) and CAMILLE DREYFUS. Behaviour of Dibasic β -Hydroxy-acids on Boiling with Aqueous Sodium Hydroxide	i, 426
DERÔME (JUVÉNAL). Action of Cyanogen Chloride on Ethyl Acetonedicarboxylate	i, 426
THOMAS-MAMERT (RENÉ) and ST. WEIL. Action of Hydrocyanic acid on Ethyl Cetipate	i, 427
PINNER (ADOLF). Compounds of Bromal with Formaldehyde	i, 427
FRANKE (ADOLF). Action of Bromine on Polymeric Aldehydes. I.	i, 427
FRANKE (ADOLF). 2-Methyl-2-bromopropanal [α -Bromo <i>isob</i> utaldehyde]	i, 428
WESSELY (LEO). An Aldol from <i>iso</i> -Butaldehyde and Formaldehyde	i, 428
HENRICH (FERDINAND). The Negative Nature of Unsaturated Groups of Atoms	i, 429
BRAUN (JULIUS VON) and FRITZ STECHELE. Allylacetone	i, 429
LESER (GEORGES). Cyclic β -Diketones. I.	i, 430
WALDEN (PAUL). Double Thiocyanates and Cyanides	i, 430
BRAUN (JULIUS VON). Action of Cyanogen Bromide on Tertiary Amines	i, 430
STIEGLITZ (JULIUS) and RALPH H. MCKER. Methyl <i>isocarb</i> amide	i, 431
BIILMANN (EINAR). Action of Allyl Alcohol and of Ethylene on Mercuric salts	i, 431
WILLGERODT (CONRAD) and HEINRICH ROGGATZ. Iodoso-, Iodoxy-, and Iodonium compounds derived from Iodo- and Chloriodo-mesitylene	i, 432
JACKSON (CHARLES LORING) and F. H. GAZZOLO. Certain Coloured Substances derived from Nitro-compounds	i, 433
MARCKWALD (WILHELM). Alkylation of Indene	i, 434
BAMBERGER (EUGEN) and FRED. TSCHIRNER. Oxidation of Aniline	i, 435
BAMBERGER (EUGEN) and ERNST HOFF. Direct Introduction of Nitro-groups into the Side Chain of Aromatic Amines	i, 435

	PAGE
BAMBERGER (EUGEN) and ERNST HOFF. Dehydration of Amine Nitrates to Nitramines (Diazotic acids)	i, 435
SCHOLL (ROLAND) and WILHELM NÖRR. Action of Cyanogen Bromide on Dimethyl- and Diethyl-aniline	i, 435
WISLIZIENUS (WILHELM) and MAX GOLDSCHMIDT. Molecular Rearrangement of Imino-ethers by Heat	i, 435
SCHOLL (ROLAND) and WILHELM NÖRR. Action of Cyanogen Bromide on Phenol	i, 436
HENRICH (FERDINAND). Nitroso-orscinol	i, 436
GOLDSCHMIDT (CARL). Reactions of Formaldehyde	i, 436
GOLDSCHMIDT (CARL). Action of Formaldehyde on Methylaniline	i, 436
BAEYER (ADOLF VON) and VICTOR VILLIGER. Benzoyl Hydrogen Peroxide. Oxidation of Benzaldehyde in Air	i, 437
WALTHER (REINHOLD VON) and A. WETZLICH. Action of Aldehydes on Phenylacetic acid and Benzyl Cyanide and some of its derivatives with the Formation of Stilbene and Stilbene derivatives	i, 438
EINHORN (ALFRED) [and in part HUGO HÜTZ and BALTHASAR PFYL]. New Drugs [Aromatic Hydroxy-acids and Esters]	i, 439
BISCHOFF (CARL A.) [and in part FRÄNKEL, GOHS, and WENGEL]. Formation of Chains. L. The Three Sodium Nitrophenoxides	i, 442
BISCHOFF (CARL A.) [and in part HERR, JENTSCHMEN, and SBYROTSCHKIN]. Formation of Chains. LI. Chloro- and Bromo-phenols. Summary of Quantitative Results on the Condensation of Phenols	i, 443
LUDEWIG (H.). Catecholacetic acid	i, 443
SEVERIN (ÉMILE C.). Dichlorophthalic acids. Products of Condensation	i, 445
BISCHOFF (CARL ADAM). Formation of Chains. LII. Derivatives of Catechol	i, 445
BISCHOFF (CARL A.) [and in part ABRAMSON, AGROZKIN, and MINSKI]. Formation of Chains. LIII. Derivatives of Resorcinol and Orcinol	i, 446
BISCHOFF (CARL A.) [and in part BASSEWICZ, DUNIN-SULGUSTOWSKI, OLZEWSKI, and STIELMANN]. Formation of Chains. LIV. Derivatives of Quinol	i, 446
MEYER (HANS). Tetrabromophenolphthalein	i, 447
ORNDORFF (WILLIAM R.) and C. E. BREWER. Gallein and Cœrulein	i, 447
BLUMSTEIN (J.) and STANISLAUS VON KOSTANECKI. 6:8'-Dihydroxy-flavone	i, 448
KOSTANECKI (STANISLAUS VON). Oximes of some Flavanones	i, 449
KEHRMANN (FRIEDRICH) and H. WOLFF. 7-Acetylamino- β -naphthaquinone	i, 449
SEVERIN (ÉMILE C.). Preparation of Dialkylaminodichloroanthraquinones	i, 450
NIENTOWSKI (STEFAN VON). New Homologues of Alizarin, Hystazain, and Quinizarin	i, 450
LIEBERMANN (CARL) and C. N. RIIBER. Bromine derivatives of Quinizarin	i, 451
HALLER (ALBIN) and JULES MINGUIN. Action of Hydrogen Bromide on Dextrogyrate Benzylidenecamphor, Bromobenzylcamphor, and Dextrogyrate Benzylidenecampholic and Phenylhydroxyhomocampholic acids	i, 452
BOUVEAULT (LOUIS). Rhodinol and Citronellol	i, 452
BOUVEAULT (LOUIS). Transformation of Rhodinol into Menthone	i, 452
SEMMLER (FRIEDRICH WILHELM). Pseudo- and Ortho-series of Terpenes, Terpene-alcohols, and Terpene-ketones	i, 452
HESSE (ALBERT). Essential Oil of Jasmine Blossom. IV.	i, 454
PRÖSCHER (FR.). Precipitation of Dyes by Ammonium Persulphate	i, 454
COHN (GEORG). Leucomethylene-blue	i, 455
PRUD'HOMME (MAURICE). New Colouring Matters of acid function	i, 455
PRUD'HOMME (MAURICE). New blue Colouring Matters fast to alkalis of special constitution	i, 455
KOHNER (E.). Brilliant Fast Red G	i, 455
PINNER (ADOLF) and E. KOHLHAMMER. Pilocarpine	i, 456
MARCKWALD (WILHELM), W. KLEMM, and H. TRABERT. The Pyridine Series. II.	i, 456

	PAGE
WILLSTÄTTER (RICHARD) and FRITZ IGLAUER. Action of Hypochlorous acid on Tertiary Amines	i, 458
COHN (PAUL) and ARMIN FISCHER. 4-Chloro- <i>m</i> -phenylenediamine	i, 458
THOMAS-MAMEET (RENÉ) and St. WEIL. Condensation of Ethyl Cetipate with <i>o</i> -Diamines. I. Condensation with Ethylenediamine and the Naphthylene- <i>o</i> -diamines	i, 459
FISCHER (OTTO) and EDUARD HEPP [with FRIED. LINNEMANN, ALEXANDER GUTBIER, and WALTHER DILTHER]. Safranin and Rosinduline	i, 460
FISCHER (OTTO) and EDUARD HEPP. Constitution of the Rosinduline of the Aminoazobenzene Fusion	i, 462
KEHRMANN (FRIEDRICH) and H. WOLFF. The Tenth and Eleventh Isomerides of Rosinduline	i, 463
LÖB (WALTHER). Electrolytic preparation of Colouring Matters resembling Indulines	i, 464
SCHALL (CARL). Phenylhydrazone-carbo- and -dicarbo-diimine. The decomposition product of Wessel's Dicarbo-base	i, 464
SONNEBORN (H.). Electrolytic reduction of <i>p</i> -Nitraniline	i, 464
CAZENEUVE (PAUL). Metallic compounds of Diphenylcarbazon	i, 465
CAZENEUVE (PAUL). Cuprous and Mercurous derivatives of Diphenylcarbazon	i, 465
HOPKINS (F. GOWLAND). Preparation of a pure Albumin from White of Egg	i, 466
COHN (RUDOLF). Formation of Bases from Albumin	i, 466
HERLANT (LÉON). Nucleic acids from various sources	i, 466
KOSSEL (ALBRECHT) and FR. KUTSCHER. Proteids	i, 466
PAAL (CARL). Glutinspeptone, Hydrobromide, and Hydriodide	i, 467
STEUDEL (H.) and ALBRECHT KOSSEL. Thymine	i, 467
LAPICQUE (LOUIS) and H. GILARDONI. Amount of Iron present in the Hæmoglobin of the Horse	i, 467
ÉTARD (ALEXANDRE). Hydrolysis of Fibrous Tissues	i, 468
HARLAY (V.). Action of Papain on Pepsin and Pancreatin	i, 468
GESSARD (C.). Tyrosinose	i, 468

PART II.

General and Physical Chemistry.

BENDER (CARL). Refraction of Normal Salt Solutions	ii, 461
GALITZIN (PRINCE BORIS B.) and J. WILIF. Refractive Powers of Methyl Acetate near the Critical Point	ii, 461
LE BEL (JOSEPH ACHILLE). Conditions determining the stability of Rotatory Power	ii, 462
ADRIANI (J. H.). Solidification and Transition Phenomena of Optical Antipodes	ii, 462
ULPIANI (C.) and S. CONDELLI. Asymmetry and Vitalism	ii, 463
MUGDAN (MARTIN). The Lead Accumulator	ii, 463
DANNEEL (H.). Chemical Equilibrium and Electromotive Force	ii, 464
MEYER (STEFAN). Additivity of Atomic Heat	ii, 464
SPEYERS (CLARENCE LIVINGSTON). Boiling Point Curves	ii, 464
MORESCHINI (R.). Phenomenon noticed in the Cooling of Superfused Liquids	ii, 465
SCHENCK (RUDOLF). Determination of the Transition Temperature of Monotropic Dimorphous Substances	ii, 465

	PAGE
MAGNANINI (GAETANO) and V. ZUNINO. Apparatus for determining the Calorific value of Fuels	ii, 465
PISSARJEWSKY (L.). Thermochemistry of Hyper-acids	ii, 466
BEMMELEN (JACOBUS MARTINUS VAN). Absorption. VI. Absorption of Matters from Solution	ii, 466
BAKKER (G.). Theory of Capillarity	ii, 466
JONES (HARRY C.) and ARTHUR W. SMITH. Solution Tension of Zinc in Ethyl Alcohol	ii, 467
ROTHMUND (VICTOR). Changes of Solubility on addition of Salts	ii, 467
DANNEEL (H.). Chemical Kinetics and Free Energy of the Reaction $2\text{HI} + 2\text{Ag} \rightleftharpoons 2\text{AgI} + \text{H}_2$	ii, 467
ROHLAND (PAUL). Reactions in Water and Acetone	ii, 468
ERDMANN (HUGO). Behaviour of Perfumes with Liquid Air	ii, 468
RIEBER (C. N.). Apparatus for Sublimation	ii, 468
STIEGLITZ (JULIUS). Lecture Experiments illustrating Equilibrium and Dissociation	ii, 469

Inorganic Chemistry.

GAUTIER ([ÉMILE JUSTIN] ARMAND). Limits of Combustibility of Hydrogen and Gaseous Hydrocarbons when diluted with large volumes of Air and passed over red hot Cupric Oxide	ii, 469
BACH (A.). Higher Hydrogen Peroxides	ii, 470
WACKER (LEONHARD). Evolution of Chlorine by the aid of Manganese Dioxide	ii, 470
SIEVERTS (ADOLF). Electrolytic Formation of Hypochlorites	ii, 470
WOHLWILL (HEINRICH). Electrolytic Formation of Chlorates	ii, 471
MICHAEL (ARTHUR) and WALLACE T. CONN. Chlorine Heptoxide	ii, 471
MOISSAN (HENRI) and PAUL LEBEAU. Preparation, Properties, and Analysis of Thionyl Fluoride	ii, 472
RICHARDS (THEODORE WILLIAM). Estimation of Sulphuric acid in the presence of Iron; Solid Solutions and the Hydrolysis of Chromium and Iron Salts	ii, 472
HOLLEMAN (ARNOLD FREDERIC). Spontaneous Decomposition of Thiosulphuric acid	ii, 473
CRANE (F. D.). Tellurium	ii, 473
FRENZEL (C.). Some Properties of Liquid Ammonia	ii, 474
CURTJUS (THEODOR) and AUGUST DARAPSKY. Azoimide	ii, 474
UHLENHUTH (RUDOLF). Preparation of Free Hydroxylamine	ii, 475
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Formation of Nitric acid during Combustion: Carbon	ii, 475
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Formation of Nitric acid during Combustion: Sulphur, Metals	ii, 475
WINKLER (CLEMENS). Supposed Transformation of Phosphorus into Arsenic	ii, 476
FORCRAND (ROBERT DE). Dihydroxides	ii, 476
LORENZ (RICHARD) and H. WEHLIN. Electrolysis of Sodium Chloride	ii, 476
BONNEFOI (J.). Combination of Lithium Bromide with Gaseous Ammonia	ii, 478
FORCRAND (ROBERT DE). Lithium Peroxide	ii, 478
ECKARDT (MORITZ) and EDMUND GRAEFFE. Physical Properties of Cæsium	ii, 479
FORCRAND (ROBERT DE). Anhydrous Calcium Peroxide and the Constitution of its Hydrates	ii, 479
ZUNINO (V.). Dehydration of Selenite and Hydration of Anhydrite	ii, 479
BARTHE (LEONOE). Ammonium Earthy Phosphates	ii, 480
GIESEL (FRITZ). Radioactive Barium and Polonium	ii, 480
NATTERER (KONRAD). Bronzes from Ephesus	ii, 480
BODROUX (F.). Lead and Copper Polysulphides	ii, 480
BODROUX (F.). Mercury Chlorosulphide	ii, 481
GOUY (A.). Action of Water on Mercurous Sulphate	ii, 481

	PAGE
DEMARÇAY (EUGÈNE). Unknown Earths contained in crude Samarium Oxide	ii, 481
MATIGNON (CAMILLE). Some properties of Aluminium: preparation of Hydrogen Phosphide	ii, 482
DRALE (CHRISTOPHER). Composition of Bottle Glasses	ii, 482
MORSE (HARMON N.) and J. C. OLSEN. Preparation of Permanganic Acid by Electrolysis	ii, 482
UHLENHUTH (RUDOLF). Crystalline form of the Nickel Sulphate compound of Hydroxylamine	ii, 482
FRIEDHEIM (CARL) and C. CASTENDYCK. Siliciovanadiomolybdates. I.	ii, 483
ALOY (JULES). Preparation of some Uranium Oxides	ii, 484
KOHLSCHÜTTER (VOLKMAR). Compounds of Uronic Acid with Sulphurous Acid	ii, 484
OECHSNER DE CONINCK (WILLIAM). Mode of Decomposition of certain Metallic Perchlorides	ii, 485
UHLENHUTH (RUDOLF). Platinum compounds of Hydroxylamine	ii, 485

Mineralogical Chemistry.

EDELEANU (LAZAR) and G. A. FILITI. Roumanian Petroleum	ii, 486
FEDOROFF (EUGRAPH S. VON) and W. W. NIKITIN. Minerals from the Bogoslawsk District, Urals	ii, 486
PIOLTI (GIUSEPPE). Jadeite from Piedmont	ii, 487
FROMME (JOHANNES). Minerals from the Radautal, Harz	ii, 487
WATSON (THOMAS L.). Weathering of Diabase in Virginia	ii, 488
ARTINI (ETTORE) and GILBERTO MELZI. Meteorite from Ergheo, Somaliland	ii, 488
COHEN (EMIL WILHELM). Meteoric Iron from Morradal, Norway	ii, 488
BONJEAN (EDMOND). Mineral Water from the Cold or "Park" Spring at Evaux-les-Bains (Creuse)	ii, 488
BONJEAN (EDMOND). Mineral Water from the Brault No. 3 Spring at Sallousouzan (Loire)	ii, 488
NASINI (RAFFAELE) and FRANCESCO ANDERLINI. Waters of Salsomaggiore	ii, 489

Physiological Chemistry.

WINTERNITZ (HUGO). Action of Morphine on Respiration	ii, 489
BURIAN (RICHARD) and HEINRICH SCHUB. Rôle of Purine Substances in Human Metabolism	ii, 489
PFLÜGER (EDUARD [FRIEDRICH WILHELM]). Use of Horse-flesh as Food	ii, 490
STROHMER (FRIEDRICH). Sugar as Food	ii, 490
HUGOUMENQ (LOUIS). Mineral Statics of the Human Fœtus during the last five months of Intrauterine Life	ii, 490
HOFMANN (A.). Rôle of Iron in Blood Formation	ii, 491
STRECKER (GÜNTHER). Action of Oxygen on the excised Mammalian Heart	ii, 491
LOEB (JACQUES). Value of Calcium and Potassium Ions in Cardiac Activity	ii, 491
BENEDICT (FRANCIS GANO) and EMIL OSTERBERG. Elementary Composition and Heat of Combustion of Human Fat	ii, 491
BENDIX (ERNST) and JULIUS WOHLGEMUTH. Preparation of Pure Glycogen	ii, 491
MOORE (BENJAMIN) and C. O. PURINTON. Physiology of the Suprarenal Capsules	ii, 492
PIRELLINI (GALILEO). Alimentary Oxaluria	ii, 492
LINDEMANN (W.). Action of certain Renal Poisons	ii, 492

Chemistry of Vegetable Physiology and Agriculture.

	PAGE
OMELIANSKY (V.). Fermentation of Cellulose	ii, 493
GRIMBERT (LÉON) and G. LEGROS. Identity of the Aerogenic Bacillus of Milk with the <i>Pneumobacillus</i> of Friedländer	ii, 493
NAPTAS (MDLLE.). Action of the <i>Bacillus anthracis</i> on Carbohydrates	ii, 493
MALFITANO (G.). Proteolysis produced by <i>Aspergillus niger</i>	ii, 493
ULPIANI (C.) and S. CONDELLI. Resolution of a Racemic compound by means of Moulds	ii, 493
STUTZER (ALBERT) and HJALMAR JENSEN. Denitrification	ii, 494
JENSEN (HJALMAR). Morphology and Biology of Denitrifying Bacteria	ii, 495
SOAVE (MARCO). Effect of Removing the Flowers on the Assimilation of Nitrogen by Leguminous Plants	ii, 496
THOMSON (A.). Effect of Ferments on the Germination of Old Seed	ii, 496
MILLS (EDMUND), JOHN IMRIE, and ARCHIBALD GRAY. Relation of the Ash to the Height of Plants	ii, 496
HORNBERGER (RICHARD). Distribution of Ash Constituents in the Section of the Copper Beech	ii, 496
BAIN (A.) and F. BACHOFEN. Composition of Cocoa Nut Ash	ii, 497
KELHOFER (W.). Distribution of Sugar, Acid, and Tannin in Peas	ii, 497
BOURQUELOT (ÉMILE) and J. LAURENT. Composition of the Albumens of the St. Ignatius Bean and Nux Vomica	ii, 498
ZEGA (ALEXANDER). <i>Agaricus Campestris</i>	ii, 498
BRIGHETTI (CELSE). Composition of <i>Apios tuberosa</i>	ii, 498
MALPEAUX (L.). Alinit in the cultivation of Cereals	ii, 498
MURRAY (J. ALAN). Composition of weak Straw	ii, 498
MAZÉ (PIERRE). Influence of Nitric and Ammoniacal Nitrogen on the development of Maize	ii, 499
LAWES (SIR JOHN BENNET) and SIR JOSEPH HENRY GILBERT. Agricultural, Botanical, and Chemical results of experiments on the Mixed Herbage of permanent Grass Land, conducted for many years in succession on the same Land. III. The Chemical results Sect. I.	ii, 499
OLSCHOWY (JULIUS). Flax	ii, 500
ADLER (MAX). Effect of Nitragin and Inoculation Soil on Yellow Lupins	ii, 501
WOHLTMANN (FERDINAND). Experiments with German, English, and French varieties of Mangels	ii, 501
STONE, CLINTON, KINSELY, and CAVANAUGH. Sugar Beet in 1898	ii, 501
BUBÁK (FR.). Mites in Beet Root Excrescences	ii, 501
HAGEMANN (OSKAR). Rational Feeding of Cows	ii, 502
LILIENTHAL. Feeding Experiments with Blood Molasses	ii, 502
SCHULZE (BERNHARD). Maize Germ Molasses as Food for Cows	ii, 502
RAMM (EBERHARD) and E. MÖLLER. Feeding Cows with English Cake	ii, 503
RAMM (EBERHARD) and E. MÖLLER. Feeding Cows with Bassia Nut and Palm-bassia Cake	ii, 503
RAMM (EBERHARD) and E. MÖLLER. Feeding Cows with Tropon	ii, 503
ZEGA (ALEXANDER). "Manur."	ii, 503
FEILITZEN (CARL VON). Soil Analyses	ii, 504
WOLLNY (MARTIN EWALD). Effect of Carbon Disulphide on the Fertility of Arable Soil	ii, 504
BÄSSLER (PAUL). Experiments on the Schultz-Lupitz System	ii, 504
EMMERLING (ADOLF) and H. WEHNERT. Composition of the Soil under Paved and other Manure Courts at Different Depths	ii, 505
ZECCHINI (MARIO) and R. NUvoli. Manurial Experiments on Irrigated Meadows	ii, 505
DICKSON (D.). and L. MALPEAUX. Nitragin	ii, 505
SCHRIEBAUX (E.). Nitragin	ii, 505
LARSEN (H. C.). Importance of various Plants employed for Green Manuring for increasing the amount of Nitrogen in the Soil	ii, 505
MÜLLER (HERMANN). Effect of Manuring on the Inner Processes of some Plants	ii, 506

	PAGE
JOHNSON (SAMUEL W.), EDWARD H. JENKINS, and W. E. BRITTON. Avail- ability of Fertiliser Nitrogen	ii, 506
SCHREIBER (CONSTANT). Phosphates	ii, 506
WAGNER (PAUL). Basic Slag for Spring Manuring	ii, 507
LEWIS (J.). Composition of Kraal Manure	ii, 507

Analytical Chemistry.

ASTRUO (A.). Acidimetry	ii, 508
LOHSE (OTTO) and P. THOMASCHESKI. Asbestos Filters	ii, 508
SCHMIDT (C.). Technical Gas Analysis	ii, 508
COHNHEIM (OTTO) and H. KRIEGER. Estimation of Combined Hydro- chloric Acid in Gastric Juice	ii, 508
MEILLERE (G.). Estimation of Chlorine in Gastric Juice	ii, 509
SCHUYTEN (M. C.). Chemical Processes in the Stomach	ii, 509
ACKERMANN (EUG.). Estimation of Ozone from Ozonisers of large Dimensions	ii, 509
MEHRING (H.). An Addition to the Apparatus for Kjeldahl's Nitrogen Estimation	ii, 509
ROMIJN (GYSBERT). Estimation of Nitrous Acid	ii, 510
PLOT (J.). Estimation of the Phosphoric Acid available as Plant Food in Soils and Manures	ii, 510
GRASSINI (R.). Sodium Amylaxanthate in Qualitative Analysis	ii, 510
BLUM (L.). Direct Estimation of Calcium in Presence of Iron and Aluminium	ii, 511
ERDMANN (HUGO) and M. VON UNRUH. Analysis of Calcium Carbide	ii, 511
MAGNANINI (GAETANO) and F. VANNINI. Evaluation of Commercial Calcium Carbide	ii, 511
LEHMANN (MARTIN). Volumetric Estimation of Mercuric Chloride in Dressings	ii, 511
FLATH (J.). Dry Assay of Lead	ii, 512
BLUM (L.). Estimation of Iron in Tap Cinder	ii, 512
FIEBER (RUDOLF). Simple Method for Decomposing Chrome Iron Ore	ii, 512
WIRTHLE (F.). Tin in Preserved Meat: its Estimation and the State in which it occurs	ii, 512
RÖSSING (ADELBERT). Tinned Fish	ii, 513
CANDUSSIO (G.). A New Reagent for Phenolic Compounds	ii, 513
LANDIN (JOHN). Detection of Sucrose in Lactose	ii, 514
SWOBODA (J.). Volumetric Estimation of Free Fatty Acids	ii, 514
MESSINGER (JOSEF). Estimation of Salicylic Acid	ii, 514
WELMANS (PAUL). Hübl's Iodine Addition Method	ii, 514
JOLLES (ADOLF). Estimation of Urea in Urine	ii, 515
SPECHT (LEOPOLD) and FRITZ LORENZ. Estimation of Tannin	ii, 515
EMERY (A. L.). Soil Humus. Some Sources of Error in Analytical Methods	ii, 516
JOLLES (ADOLF). Detection of Albumin in Urine	ii, 516

INDEX OF AUTHORS' NAMES.

A.

Abramson. See C. A. Bischoff.
Ackermann, E., ii, 509.
Adler, M., ii, 501.
Adriani, J. H., ii, 462.
Agrozkin. See C. A. Bischoff.
Aloy, J., ii, 484.
Anderlini, F. See R. Nasini.
Armstrong, H. E. TRANS., 1047.
Artini, E., and G. Melzi, ii, 488.
Astruc, A., ii, 508.

B.

Bach, A., ii, 470.
Bachofen, F. See A. Bain.
Bässler, P., ii, 504.
Baeyer, A. von, and V. Villiger, i, 437.
Bain, A., and F. Bachofen, ii, 497.
Bakker, G., ii, 466.
Bamberger, E., and E. Hoff, i, 435.
Bamberger, E., and F. Tschirner, i, 435.
Barthe, L., ii, 480.
Beddow, F. See S. Ruhemann.
Bender, C., ii, 461.
Bendix, E., and J. Wohlgemuth, ii, 491.
Benedict, F. G., and E. Osterberg, ii, 491.
Bemmelen, J. M. van, ii, 466.
Berthelot, M., ii, 475.
Bertrand, G., i, 424.
Biilmann, E., i, 425, 431.
Biilmann, E., and A. Wöhlk, i, 425.
Bischoff, C. A., i, 445.
Bischoff, C. A., Abramson, Agrozkin, and Minski, i, 446.
Bischoff, C. A., Bassewicz, Dunin-Sulgustowski, Olzewski, and Stielmann, i, 446.

Bischoff, C. A., and Fränkel, Gohs, and Wengel, i, 442.
Bischoff, C. A., and Herr, Jentschmen, and Sayrotschkin, i, 443.
Blum, L., ii, 511, 512.
Blumstein, J., and S. von Kostanecki, i, 448.
Bodroux, F., ii, 480, 481.
Bonjean, E., ii, 488.
Bonnefoi, J., ii, 478.
Bourquelot, E., and J. Laurent, ii, 498.
Boveault, L., i, 452.
Braun, J. von, i, 430.
Braun, J. von, and F. Stechele, i, 429.
Brewer, C. E. See W. R. Orndorff.
Brighetti, C., ii, 498.
Britton, W. E. See S. W. Johnson.
Bubák, F., ii, 501.
Burian, R., and H. Schur, ii, 489.

C.

Candussio, G., ii, 513.
Castendyck, C. See C. Friedheim.
Cavanaugh. See Stone.
Cazeneuve, P., i, 465.
Charon, E., and Paix-Séailles, i, 423.
Clinton. See Stone.
Cohen, E. W., ii, 488.
Cohn, G., i, 455.
Cohn, P., and A. Fischer, i, 458.
Cohn, R., i, 466.
Cohnheim, O., and H. Krieger, ii, 508.
Collie, J. N., TRANS., 971.
Collie, J. N., and B. D. Steele, TRANS., 961.
Condelli, S. See C. Ulpiani.
Conn, W. T. See A. Michael.
Cormack, W., TRANS., 990.
Crafts, J. M., TRANS., 993.

Crane, F. D., ii, 473.
Curtius, T., and A. Darapsky, ii, 474.

D.

Danneel, H., ii, 464, 467.
Darapsky, A. See T. Curtius.
Demarçay, E., ii, 481.
Derôme, J., i, 426.
Dickson, D., and L. Malpeaux, ii, 505.
Divers, E., and T. Haga, TRANS., 978.
Dralle, C., ii, 482.
Dreyfus, C. See F. Fichter.
Dunin-Sulgustowski. See C. A. Bischoff.

E.

Eckardt, M., and E. Graefe, ii, 479.
Edeleanu, L., and G. A. Filiti, ii, 486.
Einhorn, A., H. Hütz and B. Pfyl, i, 439.
Emery, A. L., ii, 516.
Emmerling, A., and H. Wehnert, ii, 505.
Erdmann, H., ii, 468.
Erdmann, H., and M. von Unruh, ii, 511.
Étard, A., i, 468.

F.

Fedoroff, E. S. von, and W. W. Nikitin, ii, 486.
Feilitzen, C. von, ii, 504.
Fichter, F., and C. Dreyfus, i, 426.
Fieber, R., ii, 512.
Filiti, G. A. See L. Edeleanu.
Fischer, A. See P. Cohn.
Fischer, O., and E. Hepp, i, 459, 460, 462.
Flath, J., ii, 512.
Forcrand, R. de, ii, 476, 478, 479.
Fränkel. See C. A. Bischoff.
Franke, A., i, 427, 428.
Frenzel, C., ii, 474.
Friedheim, C., and C. Castendyck, ii, 483.
Fromme, J., ii, 487.

G.

Galitzin, B. N., and J. Wilip, ii, 461.
Gautier, A., ii, 469.
Gazzolo, F. H. See C. L. Jackson.
Gessard, C., i, 468.

Giesel, F., ii, 480.
Gilardoni, H. See L. Lapique.
Gilbert, Sir J. H. See Sir J. B. Lawes.
Goha. See C. A. Bischoff.
Goldschmidt, C., i, 436.
Goldschmidt, M. See W. Wislicenus.
Gouy, A., ii, 481.
Graefe, E. See M. Eckardt.
Grassini, R., ii, 510.
Gray, A. See E. Mills.
Grimbert, L., and G. Legros, ii, 493.

H.

Haga, T. See E. Divers.
Hagemann, O., ii, 502.
Haller, A., and J. Minguin, i, 452.
Harlay, V., i, 468.
Henrich, F., i, 429, 436.
Hepp, E. See O. Fischer.
Herlant, L., i, 466.
Herr. See C. A. Bischoff.
Hesse, A., i, 454.
Hoff, E. See E. Bamberger.
Hofmann, A., ii, 491.
Hollemann, A. F., ii, 473.
Hopkins, F. G., i, 466.
Hornberger, R., ii, 496.
Hütz, H. See A. Einhorn.
Hugounenq, L., ii, 490.

I.

Iglauer, F. See R. Willstätter.
Imrie, J. See E. Mills.

J.

Jackson, C. L., and F. H. Gazzolo, i, 433.
Jennings, E. H. See S. W. Johnson.
Jensen, H., ii, 495.
Jensen, H. See also A. Stutzer.
Jentschmen. See C. A. Bischoff.
Johnson, S. W., E. H. Jennings, and W. E. Britton, ii, 506.
Jolles, A., ii, 515, 516.
Jones, H. C., and A. W. Smith, ii, 467.

K.

Kasansky, A., i, 426.
Kehrman, F., and H. Wolff, i, 449, 468.
Kelhofer, W., ii, 497.

Klemm, W. See W. Marckwald.
 Knisley. See Stone.
 Kohlhammer, E. See A. Pinner.
 Kohlschütter, V., ii, 484.
 Kohn, E., i, 455.
 Kossel, A., and F. Kutscher, i, 466.
 Kossel, A. See also H. Steudel.
 Kostanecki, S. von, i, 449.
 Kostanecki, S. von. See J. Blumstein.
 Krieger, H. See O. Cohnheim.
 Kutscher, F. See A. Kossel.

L.

Landin, J., ii, 514.
 Lapique, L., and H. Gilardoni, i, 467.
 Lapworth, A., TRANS., 1053.
 Larsen, H. C., ii, 505.
 Laurent, J. See E. Bourquelot.
 Lawes, Sir J. B., and Sir J. H. Gilbert, ii, 499.
 Lebeau, P. See H. Moissan.
 Le Bel, J. A., ii, 462.
 Lees, F. H. See S. B. Schryver.
 Legros, G. See L. Grimbart.
 Lehmann, M., ii, 511.
 Leser, G., i, 430.
 Lespieau, R., i, 425.
 Lewis, J., ii, 507.
 Liebermann, C., and C. N. Riiber, i, 451.
 Lillenthal, ii, 502.
 Lindemann, W., ii, 492.
 Loeb, J., ii, 491.
 Löb, W., i, 464.
 Lohse, O., and P. Thomaschewski, ii, 508.
 Lorenz, F. See L. Specht.
 Lorenz, R., and H. Wehrlin, ii, 476.
 Lubarsky, E., i, 422.
 Ludewig, H., i, 443.

M.

McKee, R. H. See J. Steiglitz.
 Magnanini, G., and F. Vannini, ii, 511.
 Magnanini, G., and V. Zunino, ii, 465.
 Malfitano, G., ii, 493.
 Malpeaux, L., ii, 498.
 Malpeaux, L. See D. Dickson.
 Maquenne, L., i, 423.
 Marckwald, W., i, 434.
 Marckwald, W., W. Klemm, and H. Trabert, i, 456.
 Massewicz. See C. A. Bischoff.

Matignon, C., ii, 482.
 Mazé, P., ii, 499.
 Mehring, H., ii, 509.
 Meillère, G., ii, 509.
 Melzi, G. See E. Artini.
 Menschutkin, B. N. See A. A. Wolkoff.
 Messinger, J., ii, 514.
 Meyer, A., i, 447.
 Meyer, S., ii, 464.
 Michael, A., and W. T. Conn, ii, 471.
 Mills, E., J. Imrie, and A. Gray, ii, 496.
 Mills, W. S., TRANS., 1020.
 Minguin, J. See A. Haller.
 Minski. See C. A. Bischoff.
 Möller, E. See E. Ramm.
 Moissan, H., and P. Lebeau, ii, 472.
 Moore, B., and C. O. Purinton, ii, 492.
 Moreschini, R., ii, 465.
 Morse, H. N., and J. C. Olsen, ii, 482.
 Müller, H., ii, 506.
 Mugdan, M., ii, 468.
 Murray, J. L., ii, 498.

N.

Napias, Mdlla., ii, 493.
 Nasini, R., and F. Anderlini, ii, 489.
 Natterer, K., 480.
 Niemantowski, S. von, i, 450.
 Nikitin, W. W. See E. S. von Fedoroff.
 Nörr, W. See R. Scholl.
 Nuvoli, R. See M. Zecchini.

O.

Oechsner de Coninck, W., ii, 485.
 Olschowy, J., ii, 500.
 Olsen, J. C. See H. N. Morse.
 Olzewsky. See C. A. Bischoff.
 Omeliansky, V., ii, 493.
 Orndorff, W. R., and C. E. Brewer, i, 447.
 Osterberg, E. See F. G. Benedict.

P.

Paal, C., i, 467.
 Paix-Séailles. See A. Charon.
 Peachey, S. J. See W. J. Pope.
 Petrenko-Kritschenko, P. I., i, 421.
 Pfluger, E., ii, 490.
 Pfyf, B. See A. Einhorn.
 Pierallini, G., ii, 492.
 Pinner, A., i, 427.

Pinner, A., and E. Kohlhammer, i, 456.
 Piolti, G., ii, 487.
 Pissarjewsky, L., ii, 466.
 Plot, J., ii, 510.
 Pope, W. J., and S. J. Peachey, TRANS., 1072.
 Pröscher, F., i, 454.
 Prud'homme, M., i, 455.
 Purinton, C. O. See B. Moore.

R.

Ramm, E., and E. Möller, ii, 503.
 Richards, T. W., ii, 472.
 Riiber, C. N., ii, 468.
 Riiber, C. N. See also C. Lieberman.
 Rössing, A., ii, 513.
 Roggatz, H. See C. Willgerodt.
 Rohland, P., ii, 468.
 Romijn, G., ii, 510.
 Rothmund, V., ii, 467.
 Ruhemann, S., and F. Beddow, TRANS., 984.

S.

Sabatier, P., and J. B. Senderens, i, 421.
 Schall, C., i, 464.
 Schenck, R., ii, 465.
 Schmidt, C., ii, 508.
 Scholl, R., and W. Nörr, i, 435, 436.
 Schreiber, C., ii, 506.
 Schriebeaux, E., ii, 505.
 Schryver, S. B., and F. H. Lees, TRANS., 1024.
 Schulze, B., ii, 502.
 Schur, H. See E. Burian.
 Schuyten, M. C., ii, 509.
 Semmler, F. W., i, 452.
 Senderens, J. B. See P. Sabatier.
 Severin, E. C., i, 445, 450.
 Sieverts, A., ii, 470.
 Smith, A. W. See H. C. Jones.
 Soave, M., ii, 496.
 Sonneborn, H., i, 464.
 Specht, L., and F. Lorenz, ii, 515.
 Speyers, C. L., ii, 464.
 Ssyrotschkin. See C. A. Bischoff.
 Stechele, F. See J. von Braun.
 Steele, B. D. See J. N. Collie.
 Steudel, H., and A. Kossel, i, 467.
 Stieglitz, J., ii, 469.
 Stieglitz, J., and R. H. McKeo, i, 431.
 Stielmann. See C. A. Bischoff.
 Stone, Clinton, Kinsley, and Cavanaugh, ii, 501.

Strecker, G., ii, 491.
 Strohmer, F., ii, 490.
 Stutzer, A., and H. Jensen, ii, 494.
 Swoboda, J., ii, 514.

T.

Thomaschewski, P. See O. Lohse.
 Thomas-Mamert, R., and S. Weil, i, 427.
 Thomson, A., ii, 496.
 Trabert, H. See W. Marckwald.
 Tschirner, F. See E. Bamberger.

U.

Uhlenhuth, R., ii, 475, 482, 485.
 Ulpiani, C., and S. Condelli, ii, 463, 493.
 Unruh, M. von. See H. Erdmann.

V.

Vannini, F. See G. Magnanini.
 Villiger, V. See A. von Baeyer.

W.

Wacker, L., ii, 470.
 Wagner, P., ii, 507.
 Walden, P., i, 430.
 Walther, R. von, and A. I. Wetzlich, i, 438.
 Watson, T. L., ii, 487.
 Wehnert, H. See A. Emmerling.
 Wehrlin, H. See R. Lorenz.
 Weil, S. See R. Thomas-Mamert.
 Welmans, P., ii, 514.
 Wengel. See C. A. Bischoff.
 Wessely, L., i, 428.
 Wetzlich, A. I. See R. von Walther.
 Whiteley, M. A., TRANS., 1040.
 Wilip, J. See B. N. Galitzin.
 Willgerodt, C., and H. Roggatz, i, 432.
 Willstätter, R., and F. Iglauer, i, 458.
 Winkler, C., ii, 476.
 Winternitz, H., ii, 489.
 Wirthle, F., ii, 512.
 Wislicenus, W., and M. Goldschmidt, i, 435.
 Wittorf, N. M., i, 421.
 Wöhlk, A., i, 425.
 Wöhlk, A. See E. Biilmann.

Wohlgemuth, J. See E. Bendix.	Z.
Wohltmann, F., ii, 501.	
Wohlwill, H., ii, 471.	Zeschini, M., and R. Nuvoli, ii, 505.
Wolff, H. See E. Kehrmann.	Zega, A., ii, 498, 504.
Wolkoff, A. A., and B. N. Menshutkin, i, 423.	Zehenter, J., i, 424.
Wollny, E., ii, 504.	Zunino, V., ii, 479.
	Zunino, V. See G. Magnanini.

ERRATA.

VOL. LXXVII. (TRANS., 1900).

Page	Line	
986	24	<i>should read</i> "0·2415 gave 0·1268 Na_2SO_4 . Na=17·01.
"	4*	" "0·2357 gave 0·1554 Na_2SO_4 . Na=21·34.
"	3*	" $\text{C}_2\text{H}_5\text{O}_2\text{NNa}$ requires Na=21·49 per cent."

* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
XCV.—Asymmetric Optically Active Sulphur Compounds. <i>d</i> -Methylethylthetine Platinichloride. By WILLIAM JACK- SON POPE and STANLEY JOHN PEACHEY (<i>Continued</i>) . . .	1073
XCVI.—A New Method of Estimating Potassium. By RICHARD HALIBURTON ADIE and THOMAS BARLOW WOOD . . .	1076
XCVII.—Notes on the Chemistry of Chlorophyll. By LEON MARCHLEWSKI, Ph.D., and C. A. SCHUNCK . . .	1080
XCVIII.—Sulvanite, a New Mineral. By G. A. GOYDER . . .	1094
XCIX.—Acetyl and Phenacetyl Derivatives of Diethyl <i>d</i> -Tar- trate. By JOHN McCRAE and T. S. PATTERSON . . .	1096
C.—Estimation of Atmospheric Carbon Dioxide. By JAMES WALKER	1110
CI.—Periodides of Substituted Oxonium Derivatives. By J. N. COLLIE, F.R.S., and B. D. STEELE, B.Sc. (Melbourne), 1851 Exhibition Scholar	1114
CII.—Condensation of Phenols with Esters of the Acetylene Series. Part II. Action of Phenols on Ethyl Phenylpro- piolate and Ethyl Acetylenedicarboxylate. By SIEGFRIED RUHEMANN and FRED BEDDOW, D.Sc., Ph.D. . . .	1119
CIII.—Vapour Pressures, Specific Volumes, and Critical Constants of Diisopropyl and Diisobutyl. By SYDNEY YOUNG, D.Sc., F.R.S., and EMILY C. FORTY, B.Sc. . . .	1126
CIV.—Vapour Pressures, Specific Volumes, and Critical Con- stants of Normal Octane. By SYDNEY YOUNG, D.Sc., F.R.S.	1145

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

	PAGE
MARKOWNIKOFF (WLADIMIR B.). Quaternary Paraffins. II.	i, 469
SABATIER (PAUL) and JEAN B. SENDERENS. Hydrogenation of Ethylene in the presence of reduced Metals.	i, 469
CHAVASTELON (R.). Action of Acetylene on Cuprous Chloride dissolved in Potassium Chloride solution.	i, 470
CHAVASTELON (R.). Crystalline compounds of Acetylene with Cuprous and Potassium Chlorides	i, 470
CHAVASTELON (R.). Mode of formation of the compounds $C_2H_2(Cu_2Cl_2)_n$, KCl and $C_2H_2[(Cu_2Cl_2)_n, KCl]_n$	i, 470
SABATIER (PAUL) and JEAN B. SENDERENS. Hydrogenation of Acetylene in presence of reduced Iron and Cobalt	i, 470
SABATIER (PAUL) and JEAN B. SENDERENS. Hydrogenation of Acetylene and Ethylene in the presence of finely divided Platinum.	i, 471
SABATIER (PAUL) and JEAN B. SENDERENS. Action of reduced Nickel on Acetylene.	i, 471
FISCHER (ALOIS) and BERTHOLD WINTER. Action of Sulphuric Acid on Dimethylpropanediol	i, 472
CHARON (ERNEST) and C. PAIX-SEAILLES. A product of the decomposition of Glycerol Diiodohydrin	i, 472
MAQUENNE (LÉON). Partial synthesis of <i>l</i> -Erythritol	i, 472
TAVERNE (H. J.). Methyl Ester and Amide of <i>d</i> -Valeric acid (Methyl-2-butanolic acid), and the solubility of its Silver salt	i, 472
THOMS (HERMANN). Telfairia Oil	i, 473
BIILMANN (EINAR) [and in part BJERRUM]. Anhydrous Acrylic acid.	i, 473
DOEBNER (OSCAR [GUSTAV]). Glyoxylic acid	i, 473
BOUVEAULT (LOUIS). Ethyloxalic Anhydride	i, 474
BOUVEAULT (LOUIS). Synthesis of higher Homologues of Ethyl Acetoacetate and Acetylacetone	i, 474
BLAISE (EDMOND E.). $\alpha\beta$ -Dimethylglutolactonic acid	i, 474
MARKOWNIKOFF (WLADIMIR B.). Oxidation of Cyclic compounds: α -Methyladipic acid	i, 475
CONRAD (MAX). Synthesis of $\alpha\alpha$ -Dimethylglutaconic acid	i, 475
HALLER (ALBIN) and G. BLANC. Synthesis of Ethyl β -Cyano- $\alpha\alpha$ -dimethyltricarballoylate and $\alpha\alpha$ -Dimethyltricarballoylic acid	i, 475
GULEWITSCH (WLADIMIR VON). Interaction of Ammonium Cyanide with Acetone	i, 476
RUFF (OTTO) and GERHARD OLLENDORFF. Degradation of <i>d</i> -Galactose and of Lactose: <i>d</i> -Lyxose and Galactoarabinose	i, 476
RODEWALD (HERMANN) and A. KATTEIN. Specific heat of Wheat Starch as a function of Hydration and Temperature	i, 477
RODEWALD (HERMANN) and A. KATTEIN. Natural and Artificial Starch grains	i, 477
RODEWALD (HERMANN). "Swelling" (Quellung) and Wetting	i, 477
SCHULZ (FRIEDRICH N.) and FRITZ DITTHORN. Galactosamine, a new Amino-sugar as a decomposition product of the Glucoprotein of the Albuminous Gland of the Frog	i, 478
HORNEL (M.). Halogen derivatives of Hexamethylenetetramine	i, 478
FRERIOHS (GUSTAV) and HEINRICH BECKURTS. The Thiocyanosacetic acids	i, 478
MUTHMANN (WILHELM) and E. SCHRÖDER. Cyanoselenium compounds	i, 479
ANDREASCH (RUDOLF). Methylvioluric acid and Methylidilituric acid	i, 479

	PAGE
PARTHEIL (ALFRED) and E. MANNHEIM. Mercury Antimonide and Stibonium compounds	i, 479
KAUFFMANN (HUGO). Ring-system of Benzene	i, 480
HOLLEMAN (ARNOLD F.) and B. R. DE BRUYN. Nitration of Nitrobenzene	i, 481
BLANKSMA (J. J.). General method for preparing Sulphonic derivatives by means of Disulphides	i, 482
REY (HERMANN). The number of Isomeric Naphthalene derivatives	i, 482
CURTISS (RICHARD SYDNEY). Action of Nitrous acid on Ethyl Anilino-malonate	i, 482
DIECKMANN (WILHELM). Behaviour of Phenylcarbimide with Ethyl Acetoacetate	i, 482
JACKSON (C. LORING) and R. W. FULLER. Constitution of Di- <i>p</i> -bromobenzylcyanamide	i, 482
MEYER (WILHELM). Action of Cyanogen on Aromatic Amines	i, 483
FISCHER (EMIL) and ADOLF WINDAUS. Formation of Quaternary Ammonium compounds in the case of Brominated Homologues of Aniline	i, 484
VAUBEL (WILHELM). Quinquevalent Nitrogen	i, 485
SCHROETER (GEORG) and M. PESCHKE. New Hydroxylamine derivatives of Formic acid	i, 485
NIEZKI (RUDOLF) and WILHELM PETRI. Constitution of <i>iso</i> Purpuric acid	i, 485
COUSIN (H.). Action of Nitric acid on Trichloroguaiacol	i, 487
PSCHOER (ROBERT) and C. SUMULEANU. Synthesis of Dimethylmorphol and of <i>iso</i> Methylmorphol	i, 487
VONGERICHTEN (EDUARD). Identity of Dimethylmorphol and of 3:4-Dimethoxyphenanthrene	i, 488
PSCHOER (ROBERT) and BERNHARD JABOKEL. Synthesis of 4-Hydroxyphenanthrene	i, 488
PSCHOER (ROBERT) and WALTER BUCKOW. Synthesis of 2:3-Dimethoxyphenanthrene	i, 489
SODEN (HUGO VON) and WILHELM ROJAHN. An Aromatic Alcohol in German Oil of Roses	i, 489
LEBEDEFF (S.). <i>o</i> -Methoxyphenyltrichloromethylcarbinol	i, 490
DRBOGLAUF (A.). Synthesis of Styryltrichloromethylcarbinol, and the action of 5 per cent. Aqueous Potassium Hydroxide on it	i, 490
MONTAGNE (P. J.). Action of Anhydrous Nitric acid on the Isomeric Chlorobenzoic acids and their derivatives	i, 491
AUWERS (KARL). Intramolecular rearrangement	i, 492
WHEELER (HENRY L.). Sodium Salts of the Amides	i, 492
ERLENMEYER (EMIL, jun.). Action of Benzyl Cyanide on Ethyl Cinnamate	i, 493
EINHORN (ALFRED) and MAX OPPENHEIMER. New Drugs: Glyciny derivatives of the Esters of Aromatic Amino- and Hydroxyamino-acids	i, 493
TROEGER (JULIUS) and ERICH EWERS. Alkylthiosulphonated Ethyl Acetoacetate	i, 494
BOUGAULT (J.). Oxidation of Anethole and Analogues (<i>iso</i> Safrrole, <i>iso</i> Apiole, &c.) containing Propenyl side chains	i, 495
BOUGAULT (J.). Methoxyhydratropic acid obtained by oxidising Anethole. Identity of Phloretic and Hydroparacoumaric acids	i, 495
HALLER (ALBIN) and G. BLANC. Alkyl salts of α -Cyano- β -alkyloxy-, β -phenyl-, and β -benzyl-acrylic acids	i, 496
SIMONS (HUGO) and G. WENZEL. Tribromocoumarin and its derivatives. II.	i, 496
BRÜHL (JULIUS WILHELM). Tautomeric Changes in Solution	i, 497
KLOBB ([CONSTANT] TIMOTHÉE). Synthesis of <i>S</i> -Benzoyl- α -methylpropionic (Phenylmethylbutanonic) acid	i, 497
LIMPRICHT (HEINRICH) and OTTO WIEGAND. <i>p</i> -Toluoyl- <i>o</i> -benzoic acid	i, 498
HEFFTER (ARTHUR) and W. FEUERSTEIN. Embellie acid	i, 498
MASSOL (GUSTAVE). Thermochemistry of Gallic acid	i, 499
MASSOL (GUSTAVE). Thermochemistry of 2:3:4-Trihydroxybenzoic acid	i, 499
DOEBNER (OSCAR [GUSTAV]). Synthesis of Phthalidetricarboxylic and Phthalidedicarboxylic acids: a new passage from the Aliphatic to the Aromatic Series	i, 499

	PAGE
BAMBERGER (EUGEN). Oxidation of Benzaldoxime	i, 500
THIELE (JOHANNES) and ERNST WINTER. Oxidation in presence of Acetic Anhydride and Sulphuric acid	i, 500
THIELE (JOHANNES) and HEINRICH EICHWEDE. Action of Ethyl Nitrite on Trisubstituted Phenols	i, 501
BLOCH (M.) and STANISLAUS VON KOSTANECKI. 2-Methylchromone	i, 502
KRONBERG (H.) The Friedel-Crafts Reaction	i, 502
COHENNER DE CONINCK (WILLIAM) and DERRIEN. New derivatives of Benzophenone	i, 502
DINGLINGER (PAUL). Derivatives of <i>p</i> -Aminobenzophenone	i, 503
LAGUET (B.). Action of Ethyl Mercaptan on some Diatomic Ketones	i, 503
CZAJKOWSKI (J.), STANISLAUS VON KOSTANECKI, and JOSEF TAMBOR. Synthesis of 1 : 3 : 4'-Trihydroxyflavone	i, 504
HARRIES (CARL D.). Oxidation of the Oximes of Unsaturated compounds	i, 504
THIELE (JOHANNES) and ERNST WINTER. Action of Acetic Anhydride and Sulphuric acid on Quinones	i, 504
GRAEBE (CARL) and F. HÖNIGSBERGER. Oxidation Products of Chrysene	i, 505
PARTHEIL (ALFRED) and A. VAN HAAREN. Influence of the amount of Water on the Specific Rotation of Alcoholic Solutions of Camphor. Valuation of Spirit of Camphor	i, 507
MAHLA (FRIEDRICH) and FERDINAND TIEMANN. Decomposition Products of Campherimine	i, 507
BARBIER (PHILIPPE). Citral and its Isomeric Forms	i, 508
KONDAKOFF (IWAN L.) and IWAN SCHINDELMEISER. Syntheses in the Terpene Series	i, 508
BOUVEAULT (LOUIS). Action of Fuming Nitric acid on Camphene	i, 508
MOKIEWSKY (WLADIMIR). Isoprene	i, 509
WALBAUM (HEINRICH). Civet, Jasmine, and Oil of Roses	i, 509
JEANCARD (PAUL) and SATIE. Essential Oil of Jasmine	i, 510
CATHELINEAU and JEAN HAUSSEER. Empyreumatic Oil of Juniper	i, 510
JEANCARD (PAUL) and SATIE. Essential Oil of Lavender and the causes of the variations in the amount of Esters contained in it	i, 510
JEANCARD (PAUL) and SATIE. Essential Oils of Neroli and Petit Grain	i, 511
BOURQUELOT (ÉMILE) and HENRI HÉRISSEY. Preparation of Gentiopicroin, the Glucoside of fresh Gentian Root	i, 511
MEULEN (H. TER). Glucosides containing Thiocarbimides	i, 511
LÉGER (EUGÈNE). Aloins	i, 512
SCHAEER (EDUARD). Nature of Klunge's Aloin Reactions and the oxidising action of Cupric salts in presence of Cyanogen compounds	i, 512
ZWICK (KARL G.). Colouring Matter of Annatto	i, 513
SCHMIDT (ERNST [ALBERT]). Alkaloids present in the Seeds of <i>Anagyris foetida</i>	i, 513
LITTERSCHEID (F. M.). Anagyryne	i, 513
KLOSTERMANN (MAX). Anagyryne	i, 515
SCHULZE (ERNST). Arginine	i, 515
TROEGER (JULIUS) and OTTO LINDE. Alkylthiosulphonates of organic bases	i, 515
LITTERSCHEID (F. M.). Action of Phenylthiocarbimide on Cytisine, Car-paine, and Conhydrine	i, 516
GULEWITSCH (WLADIMIR VON) and S. AMIRADŽIBI. Carnosine, a new base present in Meat Extract	i, 516
PARTHEIL (ALFRED) and A. GRONOVER. Morphine	i, 516
TROWBRIDGE (P. J.). Derivatives of Strychnine	i, 517
ANDRÉ (GUSTAVE). Action of Sulphur Dioxide and Hydrogen Sulphide on Pyridine	i, 517
HELLSING (GUSTAF). Chrysean	i, 518
MARCKWALD (WILHELM) and ERWIN MEYER. Quinoline Methiodide	i, 519
MARCKWALD (WILHELM) and ERWIN MEYER. 2-Quinolylhydrazine and its derivatives	i, 519

	PAGE
MARCKWALD (WILHELM) and M. CHAIN. 2-Lepidylhydrazine and 4-Quinaldylhydrazine	i, 521
RÜGHEIMER (LEOPOLD). Py-Benzylisoquinolines	i, 522
DECKE (HERMANN). Ammonium compounds. V. Ammonium Alcohols	i, 522
VAUBEL (WILHELM). Phenylidimine	i, 522
SEYEWETZ (ALPHONSE). Composition of compounds of Magenta with acidic colouring matters	i, 522
SCHAFOSCHNIKOFF (W. G.). New blue Dyes of the Thiazine series	i, 523
ZINCKE (THEODOR), F. STOFFEL, and E. PETERMANN. Ketochlorides and Quinones of Heterocyclic compounds and their products of change.	
Ketochlorides and Quinones of Aziminobenzene	i, 524
ZINCKE (THEODOR) and PH. SCHWARZ. Aziminol	i, 527
BAILEY (JAMES R.) and S. F. ACREE. 8-Hydroxy-5-alkyl-1:2:4-triazole-propionic acids	i, 528
PATEIN (GUSTAVE). Compounds of Diantipyrinemethane (Formopyrine)	i, 530
BAMBERGER (EUGEN). Relationship between Azoxybenzene and Diazobenzene	i, 531
BAMBERGER (EUGEN). Action of Aqueous Sodium Hydroxide on Nitrosobenzene	i, 531
STOLLÉ (ROBERT) and A. BENRATH. Metallic derivatives of <i>s</i> -Dibenzoylhydrazine and the transformation of Dibenzoylhydrazine into Azodibenzoyl	i, 531
RÜGHEIMER (LEOPOLD). Diazobenzene Nitrate from Nitrosophenylhydrazine	i, 532
FAVELL (G.). Action of Acyl Cyanoacetic Esters on Benzenediazonium and Diphenyltetrazonium Chlorides	i, 532
FORMÁNEK (EMANUEL). Action of Chloroform and Chloral Hydrate on Hæmoglobin	i, 532

PART II.

General and Physical Chemistry.

LIVING (GEORGE DOWNING). Effects of Dilution, Temperature, and other circumstances on the Absorption Spectra of Solutions of Didymium and Erbium salts	ii, 517
EBERT (HERMANN) and BERTHOLD HOFFMANN. Phosphorescence of Phosphoric Oxide	ii, 517
HEWITT (JOHN THEODORE). Relation between the Constitution and Fluorescence of some Substances	ii, 518
BECQUEREL (HENRI). Uranium Radiations	ii, 518
TOMASINA (THOMAS). Photochemical Effects produced by the Hertzian radiating waves	ii, 519
BUISSON (H.). Modification of Metallic Surfaces under the influence of Light	ii, 519
LEPETIT (ROBERTO). Brazilin and Hæmatoxylin as Photographic Developers	ii, 519
WEDELL-WEDELLSBERG (P. S.). Refutation of [Poynting's Theorem]	ii, 519
COHEN (ERNST). Thermodynamics of Normal Cells. I.	ii, 520
BARNES (H. T.). The Weston Cell as a Transition Cell, and as a standard of Electromotive Force, with a determination of the ratio to the Clark Cell	ii, 520
HILDBURGH (W. L.). New Electrolytic Cell for Rectifying Alternating Currents	ii, 520
THIEL (A.). Reversible Electrodes of the Second Order with mixed Depolarisers	ii, 521

	PAGE
MORGAN (J. LIVINGSTON R.) and W. L. HILDBURGH. Determination of Electrical Conductivity with direct Current Instruments . . .	ii, 521
KAHLENBERG (LOUIS). Electrolytic Deposition of Metals from Non-aqueous Solutions . . .	ii, 521
PETERSEN (JULIUS). Electrolysis of the Alkali salts of Organic acids . . .	ii, 522
MORITZ (B.). Electrolysis through Semipermeable Membranes . . .	ii, 522
BARNES (JAMES). Conductivity of Aqueous Solutions of Hydrochloric and Sulphuric acids . . .	ii, 522
JAHN (HANS). Degree of Dissociation and Dissociation Equilibrium of Highly-dissociated Electrolytes . . .	ii, 522
SKINNER (SIDNEY). Electrochemical Equivalent of Carbon . . .	ii, 523
STEINMANN (ÉMILE). Thermo-electrical Properties of Alloys . . .	ii, 523
STEINMANN (ÉMILE). Thermo-electricity of certain Alloys . . .	ii, 524
HEEN (A. DE). Transparency of various Liquids to Electric Oscillations . . .	ii, 524
FORCHHEIMER (J.). Electromagnetic Rotation of the Plane of Polarisation in Solutions of Salts and Acids . . .	ii, 524
DUHEM (PIERRE). Permanent Change and Thermodynamics . . .	ii, 524
TILDEN (WILLIAM AUGUSTUS). Specific Heats of Metals and the relation of Specific Heat to Atomic Weight . . .	ii, 524
AMAGAT (ÉMILE HILAIRE). Specific Heats of Fluids . . .	ii, 525
MAGNANINI (GAETANO) and V. ZUNINO. Thermal Conductivity of Nitric Peroxide as affected by changes of Temperature and Pressure . . .	ii, 525
KASTLE (J. H.). Effect of very low Temperatures on the Colour of Compounds of Bromine and Iodine . . .	ii, 526
CHAMBERS (VICTOR J.) and JOSEPH C. W. FRAZER. Minimum in the Molecular Lowering of the Freezing Point of Water, produced by certain acids and salts . . .	ii, 526
BARNES (JAMES). Depression of the Freezing Point by Mixtures of Electrolytes . . .	ii, 526
FORCRAND (ROBERT DE). Heat of Neutralisation of Hydrogen Peroxide by Lime . . .	ii, 526
FORCRAND (ROBERT DE). Heat of Dissolution of Hydrogen Peroxide: Thermal Value of the Hydroxyl Function: Influence of Hydrogen and Carbon . . .	ii, 526
FORCRAND (ROBERT DE). Acidity of Alcohols . . .	ii, 527
FORCRAND (ROBERT DE). General Theory of Acidity . . .	ii, 528
PRICE (T. SLATER). Temperature Coefficient of Ester Hydrolysis . . .	ii, 528
TAYLOR (A. ERNEST). Vapour Pressure Relations in Mixtures of two Liquids. I. and II. . .	ii, 529
BRAUN (LEONHARD). Absorption of Nitrogen and Hydrogen by Aqueous Solutions of Dissociating Substances . . .	ii, 529
COPPET (LOUIS CASIMIR DE). Temperature of Maximum Density of Solutions of Ammonium Chloride, Lithium Bromide, and Lithium Iodide . . .	ii, 529
BANCROFT (WILDER DWIGHT). Isohydic Solutions . . .	ii, 529
TOURN (CHARLES). Solubility of Mixtures of Salts having one common Ion . . .	ii, 530
STORTENBEKER (WILLEM). Solubility of Hydrated Mixed Crystals. III. . .	ii, 530
NANNES (G.). Separation in Alloys . . .	ii, 531
HOFF (JACOBUS H. VAN'T) and E. F. ARMSTRONG. Formation of Oceanic Salt deposits, particularly of the Staasfurt Beds. XVIII. Gypsum and Anhydrite. I. The Hydrate $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$. . .	ii, 531
HERZ (W.). Equilibria in the partition of an Acid between Ammonia and sparingly soluble Metallic Hydroxides . . .	ii, 532
WESCHIEDER (RUDOLF). Molecular Transformation of Cinchonine: an addition to the Theory of Catalytic action . . .	ii, 532
EULER (HANS). Theory of Catalytic actions . . .	ii, 532
RICHARDS (THEODORE WILLIAM). The Driving Tendency of Physico-chemical Reaction and its Temperature Coefficient . . .	ii, 533
MUTHMANN (WILHELM). G. Linck's Crystallographic views . . .	ii, 533
MEYER (STEFAN). Additive nature of the Properties of Atoms . . .	ii, 533

	PAGE
LANDOLT (HANS), WILHELM OSTWALD, and KARL SNUBERT. Second Report of the Committee of the German Chemical Society on Atomic Weights	ii, 533
HINRICHS (GUSTAVUS [DETLEF]). True Atomic Weights of ten Elements deduced from recent researches	ii, 534
KNOVENAGEL (EMIL). Thiele's Theory of partial Valencies in the light of Stereochemistry	ii, 534
THIELE (JOHANNES). The Steric aspect of partial Valencies	ii, 534
MILLER (W. LASH) and FRANK B. KENRICK. Lecture Experiments. Reversible Chemical Reactions	ii, 534
RICHARDS (WILLIAM THEODORE). Method for Testing Weights	ii, 534
FOGETTI (LUCIEN). Receiver for Fractional Distillation in a Vacuum	ii, 535

Inorganic Chemistry.

BRÜHL (JULIUS WILHELM). Hydrogen Peroxide	ii, 535
BERG (ARMAND). Action of Iodides and of Hydriodic acid on Sulphur Dioxide	ii, 535
PÉCHARD (E.). Action of Oxidising Agents on Alkali Iodides	ii, 536
MALUS (O.). Viscosity of Sulphur at Temperatures above the Point of Maximum Viscosity	ii, 536
BAMBERGER (EUGEN). Caro's Reagent	ii, 536
NORRIS (JAMES F.) and RICHARD MOMMERS. Isomorphism of Selenium and Tellurium	ii, 537
GAUTIER ([ÉMILE JUSTIN] ARMAND). Combustible Gases of the Atmosphere: Air of Towns	ii, 537
GAUTIER ([ÉMILE JUSTIN] ARMAND). Combustible Gases of the Atmosphere: Air of Forests and High Mountains	ii, 537
GAUTIER ([ÉMILE JUSTIN] ARMAND). Combustible Gases of the Atmosphere: Air of the Sea. Existence of Free Hydrogen in the Terrestrial Atmosphere	ii, 538
BERTHELOT (MARCELLIN PIERRE EUGÈNE). Formation of Nitric acid during the Combustion of Hydrogen	ii, 538
KASTLE (J. H.) and L. O. BRATTY. Supposed Allotropism of Phosphorus Pentabromide	ii, 538
BESSON (JULES ADOLPHE). The Lower Oxides of Phosphorus	ii, 539
HINRICHS (GUSTAVUS [DETLEF]). True Atomic Weight of Boron	ii, 539
LE CHATELIER (HENRI). Expansion of Fused Silica	ii, 539
MOISSAN (HENRI) and ALFRED STOCK. Preparation and Properties of the Silicon Borides, SiB_3 and SiB_2	ii, 539
LADENBURG (ALBERT) and C. KRÜGEL. Krypton	ii, 540
GUNTZ (ANTOINE) and JULES FÉREÉ. Sodium and Potassium Amalgams	ii, 540
BROCHET (ANDRÉ). Impossibility of the Direct Formation of Potassium Chlorate by Electrolysis	ii, 541
GRÜTZNER (BRUNO). Compound of Silver Fluoride with Ammonium Fluoride	ii, 541
FOOTE (H. W.). Physicochemical Relations of Aragonite and Calcite	ii, 541
VATER (HEINRICH). Formation of Marine Anhydrite	ii, 541
SCHLÖSING (TH.). Solubility of Tricalcium Phosphate in Natural Waters in the Presence of Carbonic acid	ii, 541
CRIBB (CECIL H.). Influence of Temperature and Concentration on the Saline Constituents of Boiler Water	ii, 542
ROHSNER DE CONINCK (WILLIAM). Solubility of Cupric Chloride in Organic media	ii, 542
GRÖGER (MAX). Copper Carbonate	ii, 542
HULETT (GEORGE AUG.). Distillation of Amalgams and the Purification of Mercury	ii, 543
ROHSNER DE CONINCK (WILLIAM). Decomposition of Metallic Chlorides	ii, 543
BODEROUX (F.). Direct Formation of Crystallised Mercuric and Mercurous Iodides	ii, 543

	PAGE
PARTHEIL (ALFRED) and E. MANNHEIM. Mercury Antimonide	ii, 543
PARTHEIL (ALFRED) (with A. VAN HAAREN). Mercury Phosphide and Phosphonium compounds	ii, 543
MUTHMANN (WILHELM) and L. STÜTZEL. Ceric Sulphates	ii, 544
MUTHMANN (WILHELM) and E. BAUER. Luminescence Spectra	ii, 544
GIORGIS (GIOVANNI) and UGO ALVISEI. Natural and Artificial Pozzuolana	ii, 545
CARNOT (ADOLPHE) and GOUTAL. Chemical Constitution of Steels: Influence of Tempering on the state of Combination of Elements other than Carbon	ii, 545
FONZES-DIACON (HENRI). Iron Selenides	ii, 546
MANCHOT (WILHELM) and JOHANNES HERZOG. Behaviour of Potassium Cobaltocyanide and of Chromous Compounds towards Oxygen Gas	ii, 546
LAURENT (CHARLES). Ammonium Chromous Sulphate	ii, 547
FRIEDHEIM (CARL) and MINNA SAMELSON. Permanganomolybdates	ii, 547
DELÉPINE (MARCEL). Reduction of Tungsten Trioxide by Zinc. Preparation of Pure Tungsten	ii, 548
DITTE (ALFRED). Crystallisation of Gold	ii, 549
HEYCOCK (CHARLES T.) and FRANÇOIS H. NEVILLE. Gold-aluminium Alloys	ii, 549

Mineralogical Chemistry.

ROGERS (AUSTIN F.). Ankerite from Missouri	ii, 550
HESS (WILLIAM H.). Origin of Nitrates in Cave Earths	ii, 550
PENFIELD (SAMUEL LEWIS). Composition of Sulphohalite	ii, 550
FOUQUÉ (FERDINAND). Melilite Group of Minerals	ii, 551
TOHERNIK (G. P.). Gadolinite from Batum	ii, 551
BREUSING (EDUARD). Manganocalcite and Angolite	ii, 551
MILLER (WILLET G.). Corundum bearing Rocks of Eastern Ontario	ii, 552
PRESTON (H. L.). Meteorite from Oakley, Kansas	ii, 552
CARNOT (ADOLPHE). Analyses of French Mineral Waters	ii, 552

Physiological Chemistry.

PAIRA-MALL (L.). Digestion in Birds	ii, 553
SCHÜTZ (EMIL) and KARL H. HUPPERT. Peptic Digestion	ii, 553
BRUNO (G. G.). The Bile as a Digestive Juice	ii, 553
WALTER (A. A.). Secretion of the Pancreas	ii, 553
PFEIFFER ([FRANZ WILHELM] THEODOR [CHRISTIAN]). Metabolism in Horses	ii, 554
CHARRIN (ALBERT) and GUILLEMONAT. Influence of Extract of Ovaries on the changes produced in Nutrition during Pregnancy	ii, 554
BATAILLON (E.). Action of increased Osmotic Pressure on the Ovum	ii, 554
WINTER (JUSTIN) and FALLOISE. Relationship between the Nitrogen and Chlorides of the Stomach Contents	ii, 554
MENDEL (LAFAYETTE B.) and E. C. SCHNEIDER. Thiocyanate in Human Saliva	ii, 554
DELEZENNE (C.). Action of Anti-leucocytic Serums on Blood Coagulation	ii, 554
GLÉY (EUGÈNE) and PAUL BOURCET. Iodine in the Blood	ii, 555
LOEB (JACQUES). Artificial Production of Normal Larvæ from Unfertilised Eggs of the Sea Urchin	ii, 555
WETZEL (G.). Organic substance of the Shells of <i>Mytilus</i> and <i>Pinna</i>	ii, 555
LEVIN (ISAAO). Mucin	ii, 555
LEVENE (P. A.) and C. L. ALSBERG. Chemistry of the Parannucleo-compounds	ii, 555
MENDEL (LAFAYETTE B.) and R. NAKASEKO. Chemistry of the Lymphatic Glands	ii, 556
SCHÖNDORFF (BERNHARD). Urea in Human Milk	ii, 556
PARKER (WILLIAM H.). Xanthine Bases in Fæces	ii, 556

	PAGE
LIANG (S.). Excretion of Sulphur after Extirpation of the Liver	ii, 556
BELLOOQ (A.). Albumin in Normal Urine	ii, 556
DONALDSON (HENRY H.). Decrease of Water in the Central Nervous System of the growing White Rat	ii, 556
CLEGHORN (ALLEN). Physiological Action of Extracts of Sympathetic Ganglia	ii, 557
ACHARD (CH.) and A. CLERO. Anti-rennin of Serum in Pathological Conditions	ii, 557
RICHAUD (A. and R. BONNEAU). Analysis of the Liquid contained in a Mesenteric Cyst	ii, 557
RAINY (H.). Action of Diphtheria Toxin on the Motor Cells of the Spinal Cord	ii, 557
RANSOM (F.). Diphtheritic Paralysis and Antitoxin	ii, 557
RANSOM (F.). The Lymph after Intravenous Injection of Tetanus Toxin and Antitoxin	ii, 558
MYERS (WALTER). Interaction of Toxin and Antitoxin	ii, 558
HOWELL (WILLIAM H.). Use of Alkaline Solutions in Surgical Shock	ii, 558
LEE (FREDERICK S.) and O. C. HARROLD. Action of Phloridzin on Muscle	ii, 558
LUSK (GRAHAM). Influence of Phloridzin Diabetes on Lactation	ii, 558
CHARRIN (ALBERT). Toxicity of Urine	ii, 559
KEMP (GEORGE T.) and MISS S. L. DEWEY. Action on the Heart of Toxic Products of the Typhoid Bacillus	ii, 559
STASSANO (H.). Combination of Nucleins with Metallic compounds, Alkaloids, and Toxins	ii, 559

Chemistry of Vegetable Physiology and Agriculture.

ERNST (HAROLD C.) and W. H. ROBEY, jun. Mechanism of Agglutination	ii, 560
BABCOCK (S. MOULTON), H. L. RUSSELL, and ALFRED VIVIAN. Antiseptic Value of Certain Chemicals in Milk	ii, 560
RIDEAL (SAMUEL) and A. G. R. FOULERTON. Boric acid and Formaldehyde as Milk Preservatives	ii, 560
HEHNER (OTTO). Boric acid and Formaldehyde as Food Preservatives	ii, 561
EHRHARDT. Action of Dry and Moist Air on Plants	ii, 561
SUZUKI (U.). Can Strontium and Barium Replace Calcium in Phænogams?	ii, 561
ANDERSEN (JUSTUS). Distribution of Cane Sugar in Plants	ii, 561
HARRISSEY (HENRI). Reserve Carbohydrate of the Seed of <i>Trifolium repens</i>	ii, 561
GORET (MAURICE). Composition of the Albumen of the Seed of the American Bean (<i>Gleditschia triacanthos</i>)	ii, 562
SUZUKI (U.). Arginine	ii, 562
SUZUKI (U.). Formation of Arginine in Coniferous Plants	ii, 562
BECKURTS (HEINRICH). Amount of Alkaloids in the Bark of Java Pomegranates	ii, 563
ZAY (C.). [Composition of the Flowers of the] Hollyhock	ii, 563
Asō (K.). Composition of the Spores of <i>Aspergillus oryzae</i>	ii, 563
KELLNER (OSCAR) and A. KÖHLER. Metabolism in Full-grown Bullocks with Maintenance and Fattening Foods	ii, 563
KELLNER (OSCAR), A. KÖHLER, F. BARNSTEIN, W. ZIELSTORFF, H. LÜHRIG, and F. MACH. Experiments with Gluten and Starch-meal	ii, 565
KELLNER (OSCAR), A. KÖHLER, W. ZIELSTORFF, FR. HERING, R. EWERT, and M. LEHMANN. Experiments with Gluten, Starch-meal, and Oil	ii, 565
KELLNER (OSCAR), A. KÖHLER, M. LEHMANN, FR. HERING, K. WEDDEMAYER, and TH. METHNER. Experiments with Meadow Hay, Oat Straw, Starch-meal, and Molasses	ii, 566
KELLNER (OSCAR), A. KÖHLER, M. LEHMANN, FR. HERING, K. WEDDEMAYER, J. VOLHARD, H. PETERS, H. VON GILLERN, and O. ZAHN. Experiments with Meadow Hay, Wheat Straw, Starch-meal, extracted Rye Straw, and Molasses	ii, 566

	PAGE
KELLNER (OSCAR), H. PETERS, O. ZAHN, and A. STRIGEL. Beet Molasses of different origin	ii, 566
DICKSON (D.) and L. MALPRAUX. Milk and Artificial Foods for Fattening Calves	ii, 566
HILLS (JOSEF L.). Effect of Fatigue on the Quantity and Quality of Milk	ii, 567
BARTLET (JAMES M.). Effect of Food on the Hardness of Butter and Composition of Butter Fat	ii, 567
BARTLET (JAMES M.). Effect of Feeding with Fat on the percentage of Fat in the Milk	ii, 568
HILLS (JOSEF L.). Effect of Emulsified or Non-emulsified Fat on Milk production	ii, 568
HILLS (JOSEF L.). Effect of Food on the quality of Butter	ii, 568
JAFFA (MEYER E.). Composition and Food Value of the Salt Brushes	ii, 569
COMBY (B. G.), DAVID, and FREDERICK B. GUTHRIE. Edible Earth from Fiji	ii, 569
WARINGTON (ROBERT). Basic constituents of Crops	ii, 569
DEMOUSSY (EM.). [Basic constituents of Crops]	ii, 570
STEGELICH. Manurial Experiments with Fruit Trees	ii, 570
HOLDEFLEISS (FRIEDRICH). Storage of Stable Manure	ii, 571

Analytical Chemistry.

WHITE (ALFRED H.). Burette for Accurate Gas Analysis	ii, 571
ASTRUC (A.). Alkalimetry and Acidimetry in Volumetric Analysis	ii, 572
CARNOT (ADOLPHE). New methods of Mineral analysis	ii, 572
RUPP (ERWIN). Iodometric estimation of Hydrogen Peroxide, Alkali Carbonates and Persulphates	ii, 572
PARIS (GIULIO). Detection of Fluorine in Wine	ii, 572
BRUNCK (OTTO). Estimation of Ozone	ii, 572
KELLER (EDWARD). Selenium and Tellurium	ii, 573
BENEDICT (FRANCIS GANO). Distillation of Ammonia in the Estimation of Nitrogen	ii, 573
SARGENT (GEORGE WILLIAM). Rapid Method for the Estimation of Carbon in Iron or Steel by Combustion	ii, 574
AUCHY (GEORGE). Estimation of Carbon in Steel	ii, 574
BLOUNT (BERTRAM). Estimation of Carbon and Sulphur in Steel	ii, 574
CAMERON (FRANK KENNETH). Estimation of Alkali Carbonates in presence of Alkali Hydrogen Carbonates	ii, 575
HINDS (J. I. D.). Estimation of Calcium and Sulphuric acid by the Photometric method	ii, 575
MEADE (RICHARD K.). Estimation of Zinc by the use of Standard Thio-sulphate solution	ii, 575
JOLLES (ADOLF). Quick and Exact Test for Mercury in Urine	ii, 576
PETERS (C. A.). Separation and Estimation of Mercury as Mercurous Oxalate	ii, 576
KNORRE (GEORG VON). Estimation of Cerium	ii, 576
VEITCH (F. P.). Estimation of Alumina and Ferric Oxide in Natural Phosphates	ii, 577
CAMPBELL (EDWARD D.). Preparation of Potassium Xanthate for Nickel Estimations	ii, 577
MAILLARD (LOUIS). Colorimetric Estimation of Vanadium	ii, 577
BALACHOWSKY (DIMITRY). Electrolytic Estimation of Bismuth	ii, 578
MATHEWS (JOHN ALEXANDER). Bismuth Cobalticyanide	ii, 578
VENTUROLI (GIUSEPPE). Determination of the Hardness of Water	ii, 579
DEUSSEN (ERNST). West Indian Sandalwood Oil	ii, 579
PARTHEIL (ALFRED) and A. VAN HAAREN. Valuation of Spirit of Camphor	ii, 580
HALL (A. D.). Assay of Creosote	ii, 580
RUPP (ERWIN). Volumetric Valuation of Syrup of Ferrous Iodide	ii, 580

	PAGE
LONG (JOHN HARPER). Relation of the Reducing Power of Normal Urine to the amount of certain Nitrogen compounds present	ii, 580
PFLÜGER (EDUARD [FRIEDRICH WILHELM]). Estimation of Glycogen	ii, 581
KIPPENBERGER (CARL). Estimation of Chloral Hydrate and Chloroform in Toxicological analysis	ii, 581
TOURCHOT (A. L.). Acidity of Milk	ii, 582
HUMMEL (JOHN A.). Examination of Brown and Taylor's official method of Identifying Butter	ii, 582
WILLIAMS (ROWLAND). Maize Oil	ii, 582
SCHAEER (EDUARD). Nature of Klunge's Aloin reactions and the oxidising action of Cupric salts in the presence of Cyanogen compounds	ii, 583
KATZ (JULIUS). Estimation of Santonin	ii, 583
LINDE (OTTO). Volumetric Estimation of Alkaloids	ii, 583
KIPPENBERGER (CARL). Estimation of Alkaloids by means of a titrated solution of Iodine	ii, 583
TROEGER (JULIUS) and OTTO LINDE. Estimation of Berberine	ii, 584
GUESS (H. A.). Gluten Constituents of Wheat and Flour and their Relation to Bread Making qualities	ii, 584

INDEX OF AUTHORS' NAMES.

A.

Achard, C., and A. Clerc, ii, 557.
 Acree, S. F. See J. F. Bailey.
 Adie, R. H., and T. B. Wood, TRANS., 1076.
 Alsberg, C. L. See P. A. Levene.
 Alvisi, U. See G. Giorgia.
 Amagat, R. H., ii, 525.
 Amiradžibi, S. See W. von Gulewitsch.
 Anderssen, J., ii, 561.
 André, G., i, 517.
 Andreasch, R., i, 479.
 Armstrong, E. F. See J. H. van't Hoff.
 Asô, K., ii, 563.
 Astruc, A., ii, 572.
 Anchy, G., ii, 574.
 Auwers, K., i, 492.

B.

Babcock, S. M., H. L. Russell, and A. Vivian, ii, 560.
 Bailey, J. R., and S. F. Acree, i, 528.
 Balachowsky, D., ii, 578.
 Bamberger, E., i, 500, 531; ii, 536.
 Bancroft, W. D., ii, 529.
 Barbier, P., i, 508.
 Barnes, H. T., ii, 520.
 Barnes, J., ii, 522, 526.
 Barnstein, F. See O. Kellner.
 Bartlet, J. M., ii, 567, 568.
 Bataillon, E., ii, 554.
 Baur, E. See W. Muthmann.
 Beatty, L. O. See J. H. Kastle.
 Beckurts, H., i, 563.
 Beckurts, H. See also G. Frericha.
 Becquerel, H., ii, 518.
 Beddow, F. See S. Ruhemann.
 Bellocq, A., ii, 556.
 Benedict, F. G., ii, 573.
 Benrath, A. See R. Stollé.
 Berg, A., ii, 535.

Berthelot, M. P. E., ii, 538.
 Besson, A., ii, 539.
 Biilmann, E., and Bjerrum, i, 473.
 Bjerrum. See E. Biilmann.
 Blaise, E. E., i, 474.
 Blanc, G. See A. Haller.
 Blanksma, J. J., i, 482.
 Bloch, M., and S. von Kostanecki, i, 502.
 Blount, B., ii, 574.
 Bodroux, F., ii, 548.
 Bonneau, R. See A. Richaud.
 Bougault, J., i, 495.
 Bourcet, P. See E. Gley.
 Bourquelot, E., and H. Hérissé, i, 511.
 Bouveault, L., i, 474, 508.
 Braun, L., ii, 529.
 Breusing, E., ii, 551.
 Brochet, A., ii, 541.
 Brühl, J. W., i, 497; ii, 535.
 Brunck, O., ii, 572.
 Bruno, G. G., ii, 553.
 Bruyn, B. R. de. See A. F. Holleman.
 Buckow, W. See R. Paschorr.
 Buisson, H., ii, 519.

C.

Cameron, F. K., ii, 575.
 Campbell, E. D., ii, 577.
 Carnot, A., ii, 552, 572.
 Carnot, A., and Goutal, ii, 545.
 Cathelineau and J. Hausser, i, 516.
 Chain, M. See W. Marckwald.
 Chambers, V. J., and J. C. W. Frazer, ii, 526.
 Charon, E., and C. Paix-Seailles, i, 472.
 Charrin, A., ii, 559.
 Charrin, A., and Guillemonat, ii, 554.
 Chavastelon, R., i, 470.
 Olegorn, A., ii, 557.

Clere, A. See C. Achard.
Cohen, E., ii, 520.
Collie, J. N., and B. D. Steele,
TRANS., 1114.
Comey, B. G., David, and F. B.
Guthrie, ii, 569.
Conrad, M., i, 475.
Coppet, L. C. de, ii, 529.
Cousin, H., i, 487.
Cribb, C. H., ii, 542.
Curtiss, R. S., i, 482.
Czajkowski, J., S. von Kostanecki,
and J. Tambor, i, 504.

D.

David. See B. G. Comey.
Decker, H., i, 522.
Delépine, M., ii, 548.
Delezenne, C., ii, 554.
Demoussy, E., ii, 570.
Derrien. See W. Chekaner de Con-
inck.
Deussen, E., ii, 579.
Dewey, Miss S. L. See G. T. Kemp.
Dickson, D., and L. Malpeaux,
ii, 566.
Dieckmann, W., i, 482.
Dinglinger, P., i, 503.
Ditte, A., ii, 549.
Ditthorn, F. See F. N. Schulz.
Doebner, O., i, 473, 499.
Donaldson, H. H., ii, 556.
Drboglaff, A., i, 490.
Duhem, P., ii, 524.

E.

Eberhardt, ii, 561.
Ebert, H., and B. Hoffmann, ii, 517.
Eichwede, H. See J. Thiele.
Einhorn, A., and M. Oppenheimer,
i, 498.
Erlenmeyer, E., jun., i, 493.
Ernst, H. C., and W. H. Robey, jun.,
ii, 560.
Ewers, E. See J. Troeger.
Ewert, R. See O. Kellner.
Euler, H., ii, 532.

F.

Fallose. See J. Winter.
Favrel, G., i, 532.
Férée, J. See A. Guntz.
Feuerstein, W. See A. Heffter.
Fischer, A., and B. Winter, i, 472.
Fischer, E., and A. Windaus, i, 484.

Fogetti, L., ii, 535.
Fonzes-Diacon, H., ii, 546.
Foote, H. W., ii, 541.
Forchheimer, J., ii, 524.
Forcrand, R. de, ii, 526, 527, 528.
Formánek, E., i, 532.
Fortey, E. C., (Miss). See S. Young.
Foulerton, A. G. R. See S. Rideal.
Fouqué, F., ii, 551.
Frazer, J. C. W. See V. J. Cham-
bers.
Frerichs, G., and H. Beckurts, i, 478.
Friedheim, C., and M. Samelson,
ii, 547.
Fuller, R. W. See C. L. Jackson.

G.

Gautier, A., ii, 537, 538.
Gillern, H. von. See O. Kellner.
Giorgis, G., and U. Alvisi, ii, 545.
Gley, E., and P. Bourcet, ii, 555.
Goret, M., ii, 562.
Goutal. See A. Carnot.
Goyder, G. A., TRANS., 1094.
Graebe, C., and F. Hönigsberger,
i, 505.
Gröger, M., ii, 542.
Gronover, A. See A. Partheil.
Grützner, B., ii, 541.
Guess, H. A., ii, 584.
Guillemonat. See A. Charrin.
Gulewitsch, W. von, i, 476.
Gulewitsch, W. von, and S. Amirad-
žibi, i, 516.
Guntz, A., and J. Férée, ii, 540.
Guthrie, F. B. See B. G. Comey.

H.

Haaren, A. van. See A. Partheil.
Hall, A. D., ii, 580.
Haller, A., and G. Blanc, i, 475; 496.
Harries, C. D., i, 504.
Harrold, C. C. See F. S. Lee.
Hausser, J. See Cathelineau.
Heen, A. de, ii, 524.
Heffter, A., and W. Feuerstein,
i, 498.
Hehner, O., ii, 561.
Hellsing, G., i, 518.
Hering, F. See O. Kellner.
Hérissey, H., ii, 561.
Hérissey, H. See also R. Bourquelot.
Herzog, J. See W. Manchot.
Hess, W. H., ii, 550.
Hewitt, J. T., ii, 518.
Heycock, C. T., and F. H. Neville,
ii, 549.

Herz, W., ii, 532.
 Hildburgh, W. L., ii, 520.
 Hildburgh, W. L. See also J. L. R. Morgan.
 Hills, J. L., ii, 567, 568.
 Hinds, J. I. D., ii, 575.
 Hinrichs, G., ii, 534, 539.
 Hoehnel, M., i, 478.
 Hönigsberger, F. See C. Graebe.
 Hoff, J. H. van't, and E. F. Armstrong, ii, 531.
 Hoffmann, B. See H. Ebert.
 Holdefleiss, F., ii, 571.
 Holleman, A. F., and B. R. de Bruyn, i, 481.
 Howell, W. H., ii, 558.
 Hulett, G. A., ii, 543.
 Hummel, J. A., ii, 582.
 Huppert, K. H. See E. Schütz.

J.

Jackson, C. L., and R. W. Fuller, i, 482.
 Jaeckel, B. See R. Pachorr.
 Jaffa, M. E., ii, 569.
 Jahn, H., ii, 522.
 Jeancard, P., and Satie, i, 510, 511.
 Jolles, A., ii, 576.

K.

Kahlenberg, L., ii, 521.
 Kastle, J. H., ii, 526.
 Kastle, J. H., and L. O. Beatty, ii, 538.
 Kattein, A. See H. Rodewald.
 Katz, J., ii, 538.
 Kauffmann, H., i, 480.
 Keller, E., ii, 573.
 Kellner, O., and A. Köhler, ii, 563.
 Kellner, O., A. Köhler, F. Barnstein, W. Zielstorff, H. Lührig, and F. Mach, ii, 565.
 Kellner, O., A. Köhler, M. Lehmann, F. Hering, K. Wedemeyer, and T. Methner, ii, 566.
 Kellner, O., A. Köhler, M. Lehmann, F. Hering, K. Wedemeyer, J. Volhard, H. Peters, H. von Gillern, and O. Zahn, ii, 566.
 Kellner, O., A. Köhler, W. Zielstorff, F. Hering, R. Ewert, and M. Lehmann, ii, 565.
 Kellner, O., H. Peters, O. Zahn, and A. Strigel, ii, 566.
 Kemp, G. T., and Miss S. L. Dewey, ii, 559.
 Kenrick, F. B. See W. L. Miller.

Kippenberger, C., ii, 531, 533.
 Klobb, T., i, 497.
 Klostermann, M., i, 515.
 Knoevenagel, E., ii, 534.
 Knorre, G. von, ii, 576.
 Köhler, A. See O. Kellner.
 Kondakoff, I. L., and I. Schindelmeyer, i, 508.
 Kostanecki, S. von. See M. Bloch.
 J. Czajkowski.
 Kronberg, H., i, 502.
 Krügel, C. See A. Ladenburg.

L.

Ladenburg, A., and C. Krügel, ii, 540.
 Landolt, H., W. Ostwald, and K. Seubert, ii, 533.
 Lang, S., ii, 556.
 Laurent, C., ii, 547.
 Lebedeff, S., i, 490.
 Le Chatelier, H., ii, 539.
 Lee, F. S., and C. G. Harrold, ii, 553.
 Léger, E., i, 512.
 Lehmann, M. See O. Kellner.
 Lepetit, R., ii, 519.
 Levene, P. A., and C. L. Alsberg, ii, 555.
 Levin, I., ii, 555.
 Limpricht, H., and O. Wiegand, i, 498.
 Linde, O., ii, 533.
 Linde, O. See also J. Troeger.
 Littscheid, F. W., i, 513, 516.
 Liveing, G. D., ii, 517.
 Llaguet, B., i, 503.
 Loeb, J., ii, 555.
 Long, J. H., ii, 580.
 Lührig, H. See O. Kellner.
 Lusk, G., ii, 553.

M.

McCrae, J., and T. S. Patterson, TRANS., 1096.
 Mach, F. See O. Kellner.
 Magnanini, G., and V. Zunino, ii, 525.
 Mahla, F., and F. Tiemann, i, 507.
 Maillard, L., ii, 577.
 Malpeaux, L. See D. Dickson.
 Malus, C., ii, 536.
 Manchot, W., and J. Herzog, ii, 546.
 Mannheim, E. See A. Partheil.
 Maquenne, L., i, 472.
 Marchlewski, L., and C. A. Schunck, TRANS., 1030.

Marckwald, W., and M. Chain, i, 521.
 Marckwald, W., and E. Meyer, i, 519.
 Markownikoff, W. B., i, 469, 475.
 Massol, G., i, 499.
 Mathews, J. A., ii, 578.
 Meade, R. K., ii, 575.
 Mendel, L. B., and E. C. Schneider, ii, 554.
 Mendel, L. B., and R. Nakaseko, ii, 556.
 Methner, T. See O. Kellner.
 Meulen, H. ter, i, 511.
 Meves, W., i, 488.
 Meyer, E. See W. Marckwald.
 Meyer, S., ii, 538.
 Miller, W. G., ii, 552.
 Miller, W. L., and F. B. Kenrick, ii, 534.
 Moissan, H., and A. Stock, ii, 539.
 Mokiewsky, J., i, 509.
 Mommers, R. See J. L. Norris.
 Montagne, P. J., i, 491.
 Morgan, J. L. R., and W. L. Hildburgh, ii, 521.
 Moritz, B., ii, 522.
 Muthmann, W., ii, 538.
 Muthmann, W., and E. Baur, ii, 544.
 Muthmann, W., and E. Schröder, i, 479.
 Muthmann, W., and L. Stützel, ii, 544.
 Myers, W., ii, 558.

N.

Nakaseko, R. See L. B. Mendel.
 Nannes, G., ii, 531.
 Neville, F. H. See C. T. Heycock.
 Nietzsche, R., and W. Petri, i, 485.
 Norris, J. F., and R. Mommers, ii, 537.

O.

Ochaner de Coninck, W., i, 502 ; ii, 542, 543.
 Ollendorff, G. See O. Ruff.
 Oppenheimer, M. See A. Einhorn.
 Ostwald, W. See H. Landolt.

P.

Paira-Mall, L., ii, 558.
 Paix-Seailles, C. See E. Charon.
 Paris, G., ii, 572.
 Parker, W. H., ii, 556.
 Partheil, A., and A. Gronover, i, 516.

Partheil, A., and A. van Haaren, i, 507 ; ii, 548, 580.
 Partheil, A., and E. Mannheim, i, 479 ; ii, 543.
 Patein, G., i, 530.
 Patterson, T. S. See J. McCrae.
 Péchard, E., ii, 536.
 Penfield, S. L., ii, 550.
 Peschkes, M. See G. Schroeter.
 Petermann, E. See T. Zincke.
 Peters, C. A., ii, 576.
 Peters, H. See O. Kellner.
 Petersen, J., ii, 522.
 Petri, W. See R. Nietzsche.
 Pfeiffer, T., ii, 554.
 Pflüger, E., ii, 531.
 Preston, H. L., ii, 552.
 Price, T. S., ii, 528.
 Pschorr, R., and W. Buckow, i, 489.
 Pschorr, R., and B. Jaekel, i, 488.
 Pschorr, R., and C. Sumuleanu, i, 487.

R.

Rainy, H., ii, 557.
 Ransom, F., ii, 557, 558.
 Ray, H., i, 482.
 Richards, T. W., ii, 533, 534.
 Richaud, A., and R. Bonneau, ii, 557.
 Rideal, S., and A. G. R. Foulerton, ii, 560.
 Robey, W. H., jun. See H. C. Ernst.
 Rodewald, H., i, 477.
 Rodewald, H., and A. Kattein, i, 477.
 Rogers, A. F., ii, 550.
 Rojahn, W. See H. von Soden.
 Rügheimer, L., i, 522, 532.
 Ruff, O., and G. Ollendorff, i, 476.
 Ruhemann, S., and F. Beddow, TRANS., 1119.
 Rupp, E., ii, 572 ; 580.
 Russell, H. L. See S. M. Babcock.

S.

Subatier, P., and J. B. Senderens, i, 469, 470, 471.
 Samelson, M. See C. Friedheim.
 Sargent, G. W., ii, 574.
 Satie. See P. Jeancard.
 Schaer, E., i, 512 ; ii, 538.
 Schaposchnikoff, W. G., i, 523.
 Schindelmeyer, I. See I. L. Kondakoff.
 Schloësing, T., ii, 541.
 Schmidt, E., i, 513.
 Schneider, E. C. See L. B. Mendel.
 Schöndorff, B., ii, 556.
 Schröder, E. See W. Muthmann.
 Schroeter, G., and M. Peschkes, i, 485.

Schütz, E., and K. H. Huppert, ii, 558.
 Schulz, F. N., and F. Ditthorn, i, 478.
 Schulze, E., i, 515.
 Schunck, C. A. See L. Marchlewski.
 Schwarz, P. See T. Zincke.
 Senderens, J. B. See P. Sabatier.
 Seubert, K. See H. Landolt.
 Seyewetz, A., i, 522.
 Simonis, H., and G. Wenzel, i, 496.
 Skinner, S., ii, 523.
 Soden, H. von, and W. Rojahn, i, 489.
 Stassano, H., ii, 559.
 Steele, B. D. See J. N. Collie.
 Steglich, ii, 570.
 Steinmann, K., 523, 524.
 Stock, A. See H. Moissan.
 Stoffel, F. See T. Zincke.
 Stollé, R., and A. Benrath, i, 531.
 Stortenbeker, W., ii, 530.
 Strigel, A. See O. Kellner.
 Stützel, L. See W. Muthmann.
 Sumuleanu, C. See R. Paschorr.
 Suzuki, U., ii, 561, 562.

T.

Tambor, J. See J. Czajkowski.
 Taverne, H. J., i, 472.
 Taylor, A. E., ii, 529.
 Tchernik, G. P., ii, 551.
 Thiel, A., ii, 521.
 Thiele, J., ii, 534.
 Thiele, J., and H. Eichwede, i, 501.
 Thiele, J., and E. Winter, i, 500, 504.
 Thoms, H., i, 473.
 Tiemann, F. See F. Mahla.
 Tilden, W. A., ii, 524.
 Tommasina, T., ii, 519.
 Tourchet, A. L., ii, 532.
 Touren, C., ii, 530.
 Troeger, J., and E. Ewers, i, 494.
 Troeger, J., and O. Linde, i, 515; ii, 584.
 Trowbridge, P. J., i, 517.

V.

Vater, H., ii, 541.
 Vaubel, W., i, 485, 522.
 Veitoh, F. P., ii, 577.
 Venturoli, G., ii, 579.
 Vivian, A. See S. M. Babcock.
 Volhard, J. See O. Kellner.
 Vongerichten, E., i, 488.

W.

Walbaum, H., i, 509.
 Walker, J., TRANS., 1110.
 Walter, A. A., ii, 553.
 Warrington, R., ii, 569.
 Wedell-Wedellsborg, P. S., ii, 519.
 Wedemeyer, K. See O. Kellner.
 Wegscheider, R., ii, 532.
 Wenzel, G. See H. Simonis.
 Wetzol, G., ii, 555.
 Wheeler, H. L., i, 492.
 White, A. H., ii, 571.
 Wiegand, O. See H. Limpricht.
 Williams, R., ii, 582.
 Windaus, A. See E. Fischer.
 Winter, B. See A. Fischer.
 Winter, E. See J. Thiele.
 Winter, J., and Falloise, ii, 554.
 Wood, T. B. See R. H. Adie.

Y.

Young, S., TRANS., 1145.
 Young, S., and (Miss) E. C. Fortey, TRANS., 1126.

Z.

Zahn, O. See O. Kellner.
 Zay, C., ii, 563.
 Zielstorff, W. See O. Kellner.
 Zincke, T., and P. Schwarz, i, 527.
 Zincke, T. F. Stoffel, and E. Petermann, i, 524.
 Zunino, V. See G. Magnanini.
 Zwick, K. G., i, 518.

ERRATA.

VOL. LXXVI. (ABSTR., 1899).

PART I.

Page Line

960 19* for " $C_{15}H_{20}ON_2Br_2H_2PtCl_6$ " read " $(C_{15}H_{20}ON_2Br_2)_2H_2PtCl_6$."

VOL. LXXVII. (TRANS., 1900).

1053 16 for "units" read "union."

* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
CIV.—Vapour Pressures, Specific Volumes, and Critical Constants of Normal Octane. By SYDNEY YOUNG, D.Sc., F.R.S. (<i>Continued</i>)	1149
CV.—Separation of Neobornylamine from Bornylamine. By MARTIN ONSLOW FORSTER and JAMES HART-SMITH, A.R.C.S.	1152
CVI.—Aminoamidines of the Naphthalene Series. (Third Communication on Anhydro-bases.) By RAPHAEL MELDOLA, F.R.S., and LEWIS EYNON, A.I.C.	1159
CVII.—Note on the Elimination of a Nitro-group during Diazotisation. By RAPHAEL MELDOLA and ELKAN WECHSLER	1172
CVIII.—A Contribution to the Stereochemistry of Sulphur: an Optically Active Sulphine Base. By SAMUEL SMILES, B.Sc.	1174
CIX.—Condensation of Phenols with Esters of the Acetylene Series. Part III. Synthesis of Benzo- γ -pyrone. By SIEGFRIED RUHEMANN and H. E. STAPLETON, Scholar of St. John's College, Oxford	1179
CX.—Contributions to the Chemistry of Hydrotetrazines and Triazoles. By OSWALD SILBERRAD, Ph.D.	1185
CXI.—Isomeric Dibenzyl Ketone Benzalanilines and Deoxybenzoin Benzalanilines. Part II. By FRANCIS E. FRANCIS, Ph.D., B.Sc., Lecturer in Chemistry, University College, Bristol	1192
CXII.—Condensation of Methyl Acetonedicarboxylate. Constitution of Orcinoltricarboxylic Esters. By F. W. DOOTSON, M.A.	1196
CXIII.—Contribution to the Chemistry of the Aromatic Metadamines. By GILBERT THOMAS MORGAN, D.Sc.	1202
CXIV.—Action of Aromatic Aldehydes on Derivatives of β -Naphthylamine. By GILBERT THOMAS MORGAN, D.Sc.	1210
CXV.—Action of Hydrogen Peroxide on Carbohydrates in the Presence of Ferrous Salts. II. By ROBERT SELBY MORRELL, M.A., Ph.D., and JAMES MURRAY CROFTS, M.A., B.Sc.	1219

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry.

	PAGE
MABERY (CHARLES F.) [and in part EDWARD J. HUDSON, S. TAKANO, and W. O. QUAYLE]. Composition of Petroleum	i, 533
SABATIER (PAUL) and JEAN B. SENDERENS. Action of Finely Divided Platinum, Cobalt and Iron on Acetylene and Ethylene	i, 534
BASCHIERI (A.). Behaviour of Acetylene on Oxidation	i, 534
CROSS (CHARLES F.), EDWARD J. BEVAN, and TH. HEIBERG. Action of Hydrogen Peroxide on Unsaturated Hydrocarbons	i, 534
BILTZ (HEINRICH) and ERICH KEDESZY. Nitrotri-iodoethylene and Dinitro-di-iodoethylene	i, 534
GUSTAVSON (GABRIEL). Influence of Hydrobromic Acid on the Rate of Action of Bromine on Trimethylene	i, 535
ECHSNER DE CONINCK (WILLIAM). Solutions of Ferric Chloride in Organic Solvents	i, 535
ZUNINO (V.). Action of Potassium Hydroxide on Epichlorhydrin in the Presence of Alcohols. II.	i, 535
WENZEL (G.). Action of Bromine and Carbon Disulphide on Sodium Methylene Compounds	i, 536
MELIKOFF (PETR. G.). Haloid Hydroxy-acids	i, 536
DOEBNER (OSCAR). Synthesis of Sorbic Acid	i, 536
SABBATANI (LUIGI). Oxidation of Citric Acid and Citrates with Potassium Permanganate or with Iron	i, 536
HENRY (LOUIS). Reactions of Paraformaldehyde	i, 537
HENRY (LOUIS). Methyl Ethyl Ketone	i, 537
HILL (HENRY B.), CHARLES A. SOOH, and GEORGE OENSLAGER. Condensation of Nitromalonic Aldehyde with Ketones and Ketonic Acids	i, 538
NEUBERG (CARL). An Optically Inactive Pentose in Urine	i, 539
FISCHER (EMIL) and OTTO RUFF. Conversion of Gulonic Acid into Xylose and Galactose	i, 539
NIEBEL (W.). Oxidation Product of Glycogen with Bromine	i, 540
FEIST (FRANZ). Sugar obtained by the Hydrolysis of Strophanthin. IV.	i, 540
NASTUKOFF (A.). Oxycelluloses and the Molecular Weight of Cellulose	i, 540
LUCK (A.) and CHARLES F. CROSS. Cellulose Nitrates	i, 541
PRIOR (EUGEN) and D. WIEGMANN. Preparation and Properties of Diastase-Achroodextrin III	i, 541
MASCETTI (E.). Ammonio-oxycobalt Thiocyanates	i, 541
LACHMAN (ARTHUR). Preparation of Zinc Ethyl	i, 542
LOISELEUR (H.). Pallado-oxalic Acid and Pallado-oxalates	i, 542
JÖRGENSEN (SOFUS M.). Constitution of Platinum Bases	i, 542
BIILMANN (EINAR). Action of Allyl alcohol on Potassium Platinochloride	i, 543
WINTREBERT (L.). Osmyloxalates	i, 543
LUNGE (GEORG) and J. AKUNOFF. Action of a Mixture of Benzene Vapour and Hydrogen on Platinum and Palladium Black	i, 543
KAUFFMANN (HUGO). The Number of Isomeric Naphthalene Derivatives	i, 544
BOERIS (GIOVANNI). Crystalline Form of Toluene	i, 544
TINGLE (ALFRED). Reactions of Aniline and of Hydroxylamine with Hydroxy- and Unsaturated Compounds	i, 544
VAUBEL (WILHELM). Removal or Substitution of Sulphonic Groups in Naphthalene Derivatives by Nascent Chlorine	i, 544
ZINCKE (THEODOR). Action of Nitrous Acid on Bromo- and Chloro-derivatives of Phenols	i, 545

	PAGE
KONTA (KARL). Derivatives of 2-Methyl-1:3:4:5-phenetrol . . .	i, 545
HERSIG (JOSEF) and F. AIGNER. Monoalkyl Ethers of Phloroglucinol . . .	i, 545
PESCI (LEONE). Organo-mercury Compounds of Benzoic Acid . . .	i, 546
GRAEBE (CARL). Commercial Dichlorophthalic Acid . . .	i, 546
GRAEBE (CARL) and S. GOUREVITZ. 3:6-Dichlorophthalic Acid . . .	i, 547
GRAEBE (CARL). Formation of Esters in the Phthalic Acid Group . . .	i, 547
COHN (GEORG). Salol . . .	i, 548
BOUGAULT (J.). Synthesis of <i>p</i> -Methoxyhydratropic Acid . . .	i, 548
ZAHN (OSKAR). <i>o</i> -Aminosalicylic Acid . . .	i, 549
ERLENMEYER (EMIL), jun. α -Amino-acids . . .	i, 549
MOORE (F. J.). Removal of a Sulpho-group by Reduction . . .	i, 550
PERATONER (ALBERTO) and G. LEONARDI. Pyrone Group. VI. Con- stitution of Meconic, Comenic, and Pyromeconic Acids . . .	i, 550
PERATONER (ALBERTO) and G. LEONARDI. Pyrone Group. VII. A Con- densation Product of Acetylcarbinol . . .	i, 551
OLIVERI-TORTORICI (RICCARDO). Ethyl Dimethylpyrnedicarboxylate . . .	i, 552
POMERANZ (CESAR). Velocity of the Reaction between Sodium Hydroxide and Benzaldehyde . . .	i, 552
BENTLEY (WILLIAM B.). Action of Nitric Acid on Vanillin . . .	i, 552
ANGELI (ANGELO). Nitroketones and Orthonitro-derivatives . . .	i, 552
OLIVERI-TORTORICI (RICCARDO). Action of Nitrogen Tetroxide on Quinonedioximes . . .	i, 553
MARFORI (PIO). Hydroxymethylanthraquinones . . .	i, 553
WAGNER (GEORG) and WAULAW BRYKNER. Bornylene, a New Terpene . . .	i, 554
RIMINI (ENRICO). Isocamphor . . .	i, 554
RIMINI (ENRICO). Researches in the Camphor Group . . .	i, 555
ERDMANN (ERNST) and HUGO ERDMANN. Neroli (Orange Blossom) Oil . . .	i, 555
FEIST (FRANZ). Origin of, and Relations between, the Glucosides of <i>Stro-</i> <i>phanthus</i> . . .	i, 555
FEIST (FRANZ). Strophanthin and Strophanthidin . . .	i, 555
CZAPEK (FRIEDRICH). Chemistry of the Cell Membrane of Mosses and Liverworts . . .	i, 556
GRESHOFF (M.). Phytochemical Studies. I. Distribution of Alkaloids in the <i>Compositae</i> . . .	i, 556
HANTZSCH (ARTHUR) and M. KALB. Cotarnine Cyanide as a Pseudo-salt . . .	i, 557
TAFEL (JULIUS) and MAX STERN. Reduction of Succinimides to Pyrrol- idones . . .	i, 557
GUARESCHI (ICILIO). A New Trimethylpyridine . . .	i, 558
ORTOLEVA (GIOVANNI). Action of Iodine on a Pyridine Solution of Malonic Acid . . .	i, 558
TERNÁJGÓ (LUDWIG). Preparation of 4-Pyridinecarboxylic Acid and some of its Derivatives . . .	i, 559
PFEIFFER (P.). Tripyridinechromium Trichloride and Triethylenediamine- chromium Salts . . .	i, 559
KUHARA (M.) and M. CHIKASHIGE. Formation of Indigotin from Di- phenyldiketopiperazine . . .	i, 560
GEORGIEVICS (GEORG VON) and L. SPRINGER. Oxidation [of Indigotin] . . .	i, 560
BINZ (A.) and F. RUNG. [Crystalline Indigo-White] . . .	i, 560
PLANCHER (GIUSEPPE) [and in part ALDO BONAVIA]. Action of Alkyl Iodides on Indoles . . .	i, 560
PLANCHER (GIUSEPPE). Transformations of Tetrahydrocarbazole . . .	i, 562
PICCININI (ANTONIO) and L. SALMONI. 2-Pyrrylurethane . . .	i, 562
WHEELER (HENRY L.) and W. MURRAY SANDERS [and in part BAYARD BARNES]. Ureamino-, Thioureamino-, and Acylthioureamino-esters, and Ureamidines . . .	i, 563
WHEELER (HENRY L.) and BAYARD BARNES [and in part G. K. DUSTIN, LEEDS MITCHELL, HARRY LE B. GRAY, HENRY A. NORTH, and W. H. BUELL]. Molecular Rearrangement of Thioncarbamic, Thioncarb- anilic, and Thioncarbazine Esters: β -Alkyl- α -diketotetrahydro- thiazoles . . .	i, 564

	PAGE
BAMBERGER (EUGEN), OTTO SCHMIDT, and HERBERT LEVINSTEIN. Action of Diazobenzene on Nitromethane	i, 566
TÄUBER (ERNST) and FRANZ WALDER. Formation of a Nitrosamine by the Action of Nitrous acid on a Primary Aromatic Amine	i, 566
ENGLER (ADALBERT) and ARTHUR HANTZSCH. Diazonium Hydroxides and Diazohydroxides	i, 566
HANTZSCH (ARTHUR). <i>syn</i> Diazotates	i, 567
HANTZSCH (ARTHUR). <i>syn</i> Diazocyanides and Diazonium Cyanides	i, 567
ENGLER (ADALBERT). <i>anti</i> Diazonaphthalene Salts and Naphthylnitrosamine	i, 568
HANTZSCH (ARTHUR). Nature of the Diazohaloids	i, 568
FEIST (FRANZ). Hydrazones and Osazones from <i>p</i> -Nitrophenylhydrazine	i, 569
WALTHER (REINHOLD VON) and A. STENZ. Action of Chloroacetic acid and Chloroacetone on Thiocarbanilides and Thiosemicarbazides	i, 569
GEORGIEVICS (GEORG VON). Coloured Rosaniline Bases and their Colouring Properties	i, 569
AUTENRIETH (WILHELM) and P. RUDOLPH [and in part O. HILDEBRAND]. Preparation of Phosphoryl Derivatives of Aromatic Amines	i, 570
AUTENRIETH (WILHELM) and P. RUDOLPH. Action of Phosphorus Trichloride on Aromatic Amines in the Presence of Alkali	i, 570
MEUNIER (LOUIS). Metallic Derivatives of Diazoaminobenzene	i, 571
PRÖSCHER (FR.). Acetophenoneazobilirubin	i, 571
HENDERSON (YANDELL). Hexon Bases: Lysine	i, 571
PANORMOFF (ALEXEI A.). Action of Heat, Dilute Acids, and Alcohol on Albumin	i, 571
FARMER (J. BRETLAND). Effect of Desiccation of Albumin on its Coagulability	i, 572
KÖLLE (MARTIN). Invertin	i, 572
JONES (WALTER). Preparation of Thymine	i, 572
LEVENE (P. A.). Preparation of Nucleic Acids	i, 572
OSBORNE (THOMAS BURR) and GEORGE F. CAMPBELL. Nucleic acid of the Embryo of Wheat and its Protein Compounds	i, 573
OSBORNE (THOMAS BURR) and GEORGE F. CAMPBELL. Protein Constituents of Egg White	i, 574
SARTHOU (J.). Schinoxydase, an Oxydase present in <i>Schinus Mollis</i>	i, 575
SARTHOU (J.). Function of Iron in Schinoxydase	i, 575
FERNBACH (AUG.) and L. HUBERT. Proteolytic Diastase of Malt	i, 576

PART II.

General and Physical Chemistry.

LUNT (JOSEPH). Origins of Certain Unknown Lines in the Spectra of Stars of the β -Crucis Type, and the Spectrum of Silicon	ii, 585
PUCCIANTI (L.). Liquid Absorption Spectra in the Ultra-Red	ii, 585
WATERHOUSE (JAMES). Sensitiveness of Silver and of some other Metals to Light	ii, 585
DEBIERNE (A.). Artificial Radio-active Barium	ii, 586
DEMARÇAY (EUGÈNE). Spectrum of Radium	ii, 586
CROOKES (SIR WILLIAM). Radio-activity of Uranium	ii, 586
BEHRENDSEN (O.). Behaviour of Radium at Low Temperatures	ii, 587
ZELENY (JOHN). Velocity of the Ions produced in Gases by Röntgen Rays	ii, 587
MCLENNAN (J. C.). Electrical Conductivity in Gases traversed by Cathode Rays	ii, 587

	PAGE
HENDERSON (W. CRAIG). Electrical Effects due to Evaporation of Sodium in Air and other Gases	ii, 588
TAFEL (JULIUS). Electrolytic Reduction of Difficultly Reducible Substances in Sulphuric Acid Solution	ii, 588
MORGAN (J. LIVINGSTON B.) and W. A. DUFF. Chromium Cell for the Rectification of Alternating Currents	ii, 588
MARTIN (GEOFFREY). Existence of Thermal Centres of Stability in Compounds	ii, 589
RAYLEIGH (LORD). Weight of Hydrogen Desiccated by Liquid Air	ii, 589
BALY (EDWARD C. C.). Distillation of Liquid Air, and the Composition of the Gaseous and Liquid Phases. I. At Constant Pressure	ii, 589
RAYLEIGH (LORD). Viscosity of Argon as affected by Temperature	ii, 590
BUCHBÖCK (GUSTAV). Influence of the Medium on the Velocity of Reaction	ii, 590
VAUBEL (WILHELM). Reply to Criticism. [Chemical Affinity.]	ii, 590
ROTH (W. A.). Affinity Constants of Acids containing a Ring of Seven Carbon Atoms	ii, 590
BRUNI (GIUSEPPE) and N. PAPPADÀ. Nature and Properties of Colloidal Solutions	ii, 591
BRUNI (GIUSEPPE) and P. BERTI. Nitrogen Peroxide as a Solvent	ii, 591
BERTI (GIUSEPPE) and P. BERTI. Cryoscopic Behaviour of Nitro-derivatives in Formic Acid. I.	ii, 591
BRUNI (GIUSEPPE) and P. BERTI. Behaviour of Nitro-derivatives in Formic Acid Solution. II.	ii, 592
OSTWALD (WILHELM). Oxidations with Free Oxygen	ii, 592
CORIO (F.). Crystallographic Characters of some Isomorphous Potassium Salts	ii, 593
TUTTON (ALFRED E.). Comparative Crystallographical Study of the Double Selenates of the Series $R_2M(SeO_4)_2 \cdot 6H_2O$. I. Salts in which M is Zinc	ii, 593
LACHMAN (ARTHUR). Acetylene Gas as Fuel for Chemical Laboratories	ii, 593
DIERGAERT (PAUL). Etymological Researches on the Names of the Chemical Elements, from which the International and National Symbols are derived, with Special Reference to the German Names	ii, 593

Inorganic Chemistry.

BROCHET (ANDRÉ). Electrolysis of Concentrated Hypochlorite Solutions	ii, 594
CHATTAWAY (F. D.). Composition of Nitrogen Iodide	ii, 594
CHATTAWAY (F. D.) and K. J. P. ORTON. Action of Light on Nitrogen Iodide	ii, 594
BRACKEL (FREIHERR VON). Transformation of Hyponitrous Acid into Hydrazine	ii, 594
ANGELI (ANGELO) and FRANCESCO ANGELIO. Nitrohydroxylaminic Acid	ii, 594
SPEZIA (GIORGIO). Solubility of Quartz in Sodium Silicate Solutions	ii, 595
ZULKOWSKI (KARL). Constitution of Glass and Allied Products	ii, 595
ŠULO (OTTO KAR). So-called Electrolytic Silver Peroxide [Silver Peroxynitrate]	ii, 595
CHRISTENSEN (ODIN T.) Manganese Compounds. I. Ammonium Permanganate	ii, 596
JACKSON (C. LORING) and I. H. DERBY. Ferrous Iodide	ii, 596
MAWROW (F.). Action of Potassium Persulphate on Cobalt Salts	ii, 596
ROGERS (ALLEN) and F. H. MITCHELL. Preparation of the Blue Oxide of Molybdenum and of Metallic Molybdenum	ii, 597
MEYER (RICHARD JOS.) and RICHARD JACOBY. Double Nitrates of Quadrivalent Cerium and of Thorium	ii, 597
MUTHMANN (WILHELM) and E. BAUR. [Purification of] Commercial Thorium Nitrate	ii, 597
DEMARÇAY (EUGÈNE). Gadolinium	ii, 597
FAKTOR (FR.). Action of Sodium Thiosulphate on Potassium Antimonyl Tartrate	ii, 598

Mineralogical Chemistry.

	PAGE
WINKLER (CLEMENS). Possibility of the Transference of Metals in Igneous Rocks through the Agency of Carbon Monoxide	ii, 598
WASHINGTON (HENRY S.). Statement of Rock Analyses	ii, 598
CAVAZZI (ALFRED). Calorimetric Examination of Pyrites and Marcasite	ii, 598
SOLLY (RICHARD H.) and HENRY JACKSON. Sulpharsenites of Lead from the Binnenthal	ii, 599
HILLEBRAND (WILLIAM F.) and F. LESLIE RANSOME. Carnotite and Associated Vanadiferous Minerals in Western Colorado	ii, 599
GOLDSCHMIDT (VICTOR). Vanadinite (Endlichite) from Hillsboro', New Mexico	ii, 600
BOERIS (GIOVANNI). Perowakite from S. Ambrogio in the Valley of the Susa	ii, 600
D'ACHIARDI (GIOVANNI). Larderellite from the Suffioni of Tuscany	ii, 600
HARTLEY (ERNALD GEORGE JUSTINIAN). Plumbogummite and Hitchcockite	ii, 600
HARTLEY (ERNALD GEORGE JUSTINIAN). Beudantite	ii, 601
HUSSAK (EUGEN) and GEORGE T. PRIOR. Florencite, a new Mineral from Brazil	ii, 601
PRIOR (GEORGE T.). The Hamlinite-Florencite Group of Minerals	ii, 602
PENFIELD (SAMUEL L.). Interpretation of Mineral Analyses: Constitution of Tourmaline	ii, 602
BELLEN (E. VAN DER). Asbestos [and Chrysotile]	ii, 602
JEREMÉEFF (PAVEL V. VON). Lasur-Oligoclase from Lake Baikal	ii, 603
ZAMBONINI (FERRUCCIO). Sanidine from Monte Cimino, Rome	ii, 603
HUTCHINSON (ARTHUR). Stokesite, a new Mineral from Cornwall	ii, 603
LORD (E. C. E.). [Hornblende and Anorthoclase]	ii, 603
LACROIX (ALFRED). Prehnite in Metamorphosed Limestone	ii, 604

Physiological Chemistry.

GRANDIS (VALENTINO). Elimination of Carbon Dioxide during Respiration. I. Influence of the Concentration of the Blood on the Tension of the Carbon Dioxide in it	ii, 604
GRANDIS (VALENTINO). Elimination of Carbon Dioxide during Respiration. II. Influence of the Hygrometric State on the Passage of Carbon Dioxide from the Blood to the Air	ii, 604
MOSSO (UGOLINO). Temperature of the Body during Fasting and the Speed of Assimilation of Carbohydrates	ii, 605
MOSSO (UGOLINO). Rate of Absorption and of Assimilation of Proteids and Fats	ii, 605
HOFBAUER (LUDWIG). Absorption of Fat	ii, 605
TAYLOR (ALONZO ENGLEBERT). Pathological Fats	ii, 606
BERLIOZ (F.). The Influence of "Saccharin" [<i>o</i> -Benzoicsulphinide] on Digestion	ii, 606
JACKSON (HOLMES C.). Phosphorus in Parannuclein from Casein	ii, 606
CHARRIN (ALBERT) and A. GUILLEMONAT. Influence of Experimental Modifications on the Consumption of Sugar	ii, 606
MÜNCH (A.). Behaviour of certain Artificial Hexoses in the Animal Body	ii, 607
MENDEL (LAFAYETTE B.) and HOLMES C. JACKSON. Uric Acid Formation after Splenectomy	ii, 607
SALASKIN (SERGEI) and J. ZALESKI. Results of the Extirpation of the Liver in Dogs	ii, 607
HEMMETER (JOHN C.). Proteolytic and Amylolytic Ferments in the Contents of the Human Colon	ii, 607

	PAGE
OKER-BLOM (MAX). Physicochemical Relations of Animal Fluids and Tissues	ii, 607
LOEB (JACQUES). Artificial Parthenogenesis	ii, 608
VIGNIER. Chemical Fertilisation of Eggs	ii, 608
RANSOM (F.). Further Experiments on Tetanus Toxin and Antitoxin	ii, 608
GRANDIS (VALENTINO). Composition of the Placenta: Its Solid and Liquid Components, Organic Compounds, Extractive Matter, and Albumoses	ii, 608
GRANDIS (VALENTINO). Composition of the Ash of the Placenta	ii, 609
THUDICHUM (JOHN LEWIS W.). Some Scientific and Ethical Questions of Biological Chemistry	ii, 609

Chemistry of Vegetable Physiology and Agriculture.

BRANDT (K.). Composition of Plankton	ii, 609
MACFADYEN (ALLAN) and (in part) SYDNEY ROWLAND. Influence of the Temperature of Liquid Air on Bacteria	ii, 610
MACFADYEN (ALLAN) and SYDNEY ROWLAND. Influence of the Temperature of Liquid Hydrogen on Bacteria	ii, 610
STOKLASA (JULIUS). Present Position of the Nitragin Question	ii, 610
DAWSON (MARIA). Further Observations on Nitragin, and the Nature and Functions of the Nodules of Leguminous Plants	ii, 610
AHRENS (FELIX B.). Fermentation without Cells	ii, 610
CROSS (CHARLES FREDERICK), EDWARD JOHN BEVAN, and J. S. REMINGTON. Furfuroids of Plant Tissues	ii, 611
BOURQUELOT (ÉMILE), and J. LAURENT. Nature of the Reserve Carbohydrates in the St. Ignatius Bean and Nux Vomica	ii, 611
PETIT (PAUL) and G. LABOURASSE. Dissolution of the Nitrogenous Compounds in Malt	ii, 611
SCHULZE (ERNST). Formation and Decomposition of Albumin in the Plant	ii, 612
EMMERLING (ADOLF). Formation of Proteids in Plants	ii, 612
PALLADIN (WLADIMIR). Conditions of the Production of Proteids Insoluble in Gastric Juice and their Importance for the Respiration of Plants	ii, 612
SANI (GIOVANNI). Germination of the Olive	ii, 613
SJOLLEMA (B.). Development and Injurious Effect of Mustard Oil from Rape-Cake	ii, 613
WINDISCH (RICHARD). Action of Calcium Hydroxide on Germination	ii, 614
STOLLE (F.). Finnish Moss-Berry (<i>Vaccinium oxycoccus</i>)	ii, 614
EMMERLING (ADOLF). Composition of Fodders	ii, 614
KLEIN (OTTO). Changes in Expressed Olives when Stored under Different Conditions	ii, 615
FRIIS (F.). Experiments on Feeding Cows with Mixed Grain and Maize	ii, 615
FASCETTI and GHIGI. Composition of the Alluvial Soil of Lodi	ii, 615
IMMENDORFF (HEINRICH) and BRUNO TACKE. Vegetation Experiments with Various Peat Soils	ii, 615
HELLSTRÖM (PAUL). Action of Animal Manure on Peat Soil	ii, 616
TACKE (BRUNO), HEINRICH IMMENDORFF, A. SALFELD, and FR. WOLFF. Action of Burnt Lime and Marl on Sandy Soil	ii, 616
KLÖPPER. Top Dressing Experiments with Ammonium Sulphate and Sodium Nitrate	ii, 616
GOLDING (JOHN). Sugar as an Aid to the Growth of Plants	ii, 617
ALPE (V.). Cultivation of Mulberry Trees	ii, 617
DEHÉRAIN (PIERRE P.) and C. DUFONT. Composition of the Gas Confined in Farmyard Manure	ii, 617
SCHLOESING (TH.). Phosphoric Acid in Presence of Saturated Solutions of Calcium Hydrogen Carbonate	ii, 618
MINNSEN (H.) and BRUNO TACKE. Solubility of the Phosphoric Acid of Basic Slag and Crude Phosphates in Peat Soils. Dependence of the Solubility on the Amount of Free Humic Acid in the Soil	ii, 618

Analytical Chemistry.

	PAGE
MANLEY (J. J.). Examination of Sea Water by an Optical Method . . .	ii, 619
JEAN (FERDINAND). Qualitative Analysis of the Ammonium Sulphide Group . . .	ii, 619
THIELE (HERMANN) and R. RICHTER. Standardising Normal Acids . . .	ii, 620
MAGNIER DE LA SOURCE (LOUIS). Necessary Precautions in certain Acidimetric Estimations . . .	ii, 620
JØRGENSEN (GUNNER). Iodometric Experiments . . .	ii, 620
PANNERTZ (F.). Improvement in Péligot's Absorption Apparatus for Ammonia Estimations . . .	ii, 621
GRIFFIN (MARTIN L.). Estimation of Sulphur Dioxide in Sulphites and Thiosulphates . . .	ii, 621
MENNIGKE (H.). Detection of Nitrous Acid in Water . . .	ii, 621
GELDER (ARTHUR P. VAN). Analysis of Nitric Acid and Mixed Acid [Nitric and Sulphuric] . . .	ii, 621
SCHERBATSCHOFF (D.). Elimination of Arsenic from the System from a Toxicological Standpoint . . .	ii, 622
LETTIS (EDMUND A.) and ROBERT F. BLAKE. The Carbon Dioxide of the Atmosphere . . .	ii, 622
HOLSTE (G.). Liquid Carbon Dioxide . . .	ii, 622
BILLMANN (EINAR). Preparation of Sodium Cobalt Nitrite, and its Employment for the Detection of Potassium . . .	ii, 624
DAKIN (H. D.). The Estimation of Zinc as Phosphate . . .	ii, 624
SCHOORL (N.). Detection of Sodium in the Presence of Potassium . . .	ii, 625
GRANDIS (VALENTINO) and C. MAININI. Colour Reactions for Detecting Calcium Salts in Organic Tissues . . .	ii, 625
DUMESNIL (ERNEST). Detection of Barium, Calcium, and Strontium, and the Action of Ammonium Chloride on Strontium Chromate . . .	ii, 625
HARMON (N. MORSE) and D. W. HORN. Action of Carbon Dioxide on the Borates of Barium . . .	ii, 626
KLEIN (O. H.) and STEPHEN F. PROCKHAM. Cement Testing . . .	ii, 627
CAZENEUVE (PAUL). Diphenylcarbazide as a Sensitive Reagent for Metals . . .	ii, 627
FAKTOR (FR.). Action of Sodium Thiosulphate on Mercuric Salts . . .	ii, 627
KASTLE (J. H.) and W. A. BRATTY. Effect of Oxidising Agents on the Reduction of Mercuric Chloride by Oxalic Acid . . .	ii, 627
RUFF (ERWIN). Volumetric Estimation of Mercuric Chloride . . .	ii, 628
POWER (FREDERICK B.) and FRANK SHEDDEN. Composition and Estimation of Cerium Oxalate . . .	ii, 628
FIEBER (RUDOLF). Colorimetric Estimation of Nickel in Steel . . .	ii, 628
BASKERVILLE (CHARLES). Analysis of Titaniferous Iron Ores . . .	ii, 629
HABER (FRITZ). Estimation of Benzene and Ethylene in Coal-gas . . .	ii, 629
CHAPPELLE (PH.). Estimation of Reducing Sugar by Means of a Centrifuge . . .	ii, 629
COUNLEIGH (CONSTANTIN). Estimation of Cellulose . . .	ii, 630
KLEIBER (ALBERT). Estimation of Cell-wall Constituents, Hemicelluloses, and Cellulose in some Plants and Parts of Plants . . .	ii, 630
BORNTRÄGER (HUGO). Simple Distinction between Glue and Dextrin or Gum Arabic . . .	ii, 630
ALDEN (F. W.) and F. G. EHLERT. Estimation of Carvone in Volatile Oils. IV. . .	ii, 631
GEORGIEVICS (GEORG VON) and L. SPRINGER. Oxidation [of Oxalic Acid by Potassium Permanganate] . . .	ii, 631
LINTNER (CARL J.). Mercurisulphuric Acid and Millon's Reaction . . .	ii, 631
DITZ (HUGO). Commercially Pure Oleic Acid and Purified Oleic Acid . . .	ii, 632
JEAN (FERDINAND). Estimation of Tannic and Gallic Acids . . .	ii, 632
BELLIER (J.). Rapid Estimation of the Iodine Number of Fats . . .	ii, 632
WILLIAMS (ROWLAND). Iodine and Bromine Values of Oils and Fats . . .	ii, 633
MOLLEHNEY (PARKER C.). Linseed Oil Analysis . . .	ii, 633

	PAGE
PARTHEIL (ALFRED) and J. VON VELSEN. Refractometric Butter Analysis	ii, 633
LAM (A.). Normal Refractometric Value for Butter	ii, 634
HANUS (JOE). Rancidity of Butter	ii, 634
BREVANS (J. DE). Detection of "Saccharin" [<i>o</i> -Benzoic sulphinide] in Articles of Food	ii, 635
TROGER (JULIUS) and W. MEINE. Estimation of Sugar in Diabetic Urine	ii, 635
SALKOWSKI (ERNST). Estimation of Oxalic Acid and the Occurrence of Oxaluric Acid in Urine	ii, 635
JOLLES (ADOLF). A Quantitative Reaction of the Ureides and Purine Derivatives. II.	ii, 636
LOEWI (OTTO). Estimation of Allantoin in Urine	ii, 636
PODUSCHKA (R.). Estimation of Allantoin in Urine	ii, 636
HAMMARSTEN (OLOF). Detection of Bile Pigments in Urine	ii, 637
KIPPENBERGER (CARL). The Volumetric Estimation of Vegetable Alkaloids by Titration with Acids	ii, 637
SCHOLTZ (MAX). Quantitative Estimation of Alkaloids by means of Standardised Solution of Iodine	ii, 638
VITALI (DIOSCORIDE) and CESARE STROPPA. Chemico-toxicological Study of Coniine	ii, 639
CHÉNEAU (OCTAVE). Scheme for the Analysis of Rubber Wares	ii, 639
KISSLING (RICHARD). Chemistry of Tobacco	ii, 640

INDEX OF AUTHORS' NAMES.

A.

Ahrens, F. B., ii, 610.
 Aigner, F. See J. Herzig.
 Akunoff, J. See G. Lunge.
 Alden, F. W., and F. G. Ehlert,
 ii, 631.
 Alpe, V., ii, 617.
 Angeli, A., i, 552.
 Angeli, A., and F. Angelico, ii, 594.
 Autenrieth, W., and P. Rudolph,
 i, 570.

B.

Baly, E. C. C., ii, 589.
 Bamberger, E., O. Schmidt, and E.
 Levinstein, i, 566.
 Baschieri, A., i, 534.
 Baskerville, C., ii, 629.
 Baur, E. See W. Muthmann.
 Baynes, B. See H. L. Wheeler.
 Beatty, W. A. See J. H. Kastle.
 Behrendsen, O., ii, 587.
 Bellen, E. vander, ii, 602.
 Bellier, J., ii, 632.
 Bentley, W. B., i, 552.
 Berlioz, F., ii, 606.
 Berti, P. See G. Bruni.
 Bevan, E. J. See C. F. Cross.
 Biilmann, E., i, 543; ii, 624.
 Biltz, H., and E. Kedesdy, i, 534.
 Binz, A., and F. Rung, i, 560.
 Blake, R. F. See E. A. Letta.
 Boeris, G., i, 544; ii, 600.
 Bornträger, H., ii, 630.
 Bougault, J., i, 548.
 Bourquelot, E., and J. Laurent,
 ii, 611.
 Buchböck, G., ii, 590.
 Buell, W. H. See H. L. Wheeler.
 Brackel, Freiherr von, ii, 594.
 Brandt, K., ii, 609.
 Brévans, J. de, ii, 635.
 Brochet, ii, 594.

Bruni, G., and P. Berti, ii, 591, 592.
 Bruni, G., and N. Pappadà, ii, 591.
 Brykner, W. See G. Wagner.

C.

Campbell, G. F. See T. B. Osborna.
 Cavazzi, A., ii, 598.
 Cazeneuve, P., ii, 627.
 Chapelle, P., ii, 629.
 Charrin, A., and G. Guillemonat,
 ii, 606.
 Chattaway, F. D., ii, 594.
 Chattaway, F. D., and K. J. P.
 Orton, ii, 594.
 Chéneau, O., ii, 639.
 Chikashigé, M. See M. Kuhara.
 Christensen, O. T., ii, 596.
 Cohn, G., i, 548.
 Corio, F., ii, 593.
 Counciler, C., ii, 630.
 Crofts, J. M. See R. S. Morrell.
 Cross, C. F., E. J. Bevan, and T.
 Heiberg, i, 534.
 Cross, C. F., E. J. Bevan, and J. S.
 Remington, ii, 611.
 Cross, C. F. See also A. Luck.
 Crookes, Sir W., ii, 586.
 Czapek, F., i, 556.

D.

D'Achiardi, G., ii, 600.
 Dakin, H. D., ii, 624.
 Dawson, M., ii, 610.
 Deblerne, A., ii, 586.
 Dehérain, P. P., and C. Dupont,
 ii, 617.
 Demarçay, E., ii, 586, 597.
 Derby, J. H. See C. L. Jackson.
 Diergart, P., ii, 593.
 Ditz, H., ii, 632.

Doebner, O., i, 536.
Dootson, F. W., TRANS., 1196.
Duff, W. A. See J. L. R. Morgan.
Dumesnil, E., ii, 625.
Dupont, C. See P. P. Dehérain.
Dustin, G. K. See H. L. Wheeler.

E.

Ehlert, F. G. See F. W. Alden.
Emmerling, A., ii, 612, 614.
Engler, A., i, 568.
Engler, A., and A. Hantzsch, i, 566.
Erlenmeyer, E., jun., i, 549.
Erdmann, E., and H. Erdmann,
i, 555.
Eynon, L. See R. Meldola.

F.

Faktor, F., ii, 598, 627.
Farmer, J. B., i, 572.
Fascetti and Ghigi, ii, 615.
Feist, F., i, 540, 555, 569.
Fernálgó, L., i, 559.
Fernbach, A., and L. Hubert, i, 576.
Fieber, R., ii, 628.
Fischer, E., and O. Ruff, i, 539.
Forster, M. O., and J. Hart-Smith,
TRANS., 1152.
Francis, F. E., TRANS., 1192.
Fris, F., ii, 615.

G.

Gelder, A. P. van, ii, 621.
Georgievics, G. von, i, 569.
Georgievics, G. von, and L. Springer, i, 560; ii, 631.
Ghigi. See Fascetti.
Golding, J., ii, 617.
Goldschmidt, V., ii, 600.
Gourevitz, S. See C. Graebe.
Graebe, C., i, 546, 547.
Graebe, C., and S. Gourevitz, i, 547.
Grandis, V., ii, 604, 608, 609.
Grandis, V., and C. Mainini, ii, 625.
Gray, H. Le B. See H. L. Wheeler.
Greshoff, M., i, 556.
Griffin, M. L., ii, 621.
Guareschi, I., i, 558.
Guillemonat, A. See A. Charrin.
Gustavson, G., i, 535.

H.

Haber, F., ii, 629.
Hantzsch, A., i, 567.
Hantzsch, A., and M. Kalb, i, 557.
Hantzsch, A. See also A. Engler.
Hanus, J., ii, 634.
Hartley, E. G. J., ii, 600, 601.
Hart-Smith, J. See M. O. Forster.
Heiberg, T. See C. F. Cross.
Hellström, P., ii, 616.
Hemmeter, J. C., ii, 607.
Henderson, W. C., ii, 588.
Henderson, Y., i, 571.
Henry, L., i, 537.
Herzig, J., and F. Aigner, i, 545.
Hill, H. B., C. A. Soch, and G. Oenslager, i, 538.
Hillebrand, W. F., and F. L. Ransome, ii, 599.
Hofbauer, L., ii, 605.
Holste, G., ii, 623.
Horn, D. W. See H. N. Morse.
Hubert, L. See A. Fernbach.
Hudson, E. J. See C. F. Mabery.
Hussak, E., and G. T. Prior, ii, 601.
Hutchinson, A., ii, 608.

I.

Immendorff, H., and B. Tacke,
ii, 615.
Immendorff, H. See also B. Tacke.

J.

Jackson, C. L., and J. H. Derby,
ii, 596.
Jackson, H. See R. H. Solly.
Jackson, H. C., ii, 606.
Jackson, H. C. See also L. B. Mendel.
Jacoby, R. See R. J. Meyer.
Jean, F., ii, 619, 632.
Jeroméeff, P. V. von, ii, 603.
Jørgensen, G., ii, 620.
Jørgensen, S. M., i, 542.
Jolles, A., ii, 636.
Jones, W., i, 572.

K.

Kalb, M. See A. Hantzsch.
Kastle, J. H., and W. A. Reatty,
ii, 627.
Kauffmann, H., i, 544.
Kedesdy, E. See H. Biltz.

Kippenberger, C., ii, 637.
 Kissling, R., ii, 640.
 Kleiber, A., ii, 630.
 Klein, O., ii, 615.
 Klein, O. H., and S. F. Peckham,
 ii, 627.
 Klöpfer, ii, 616.
 Külle, M., i, 572.
 Konya, K., i, 545.
 Kuhara, M., and M. Chikashigé,
 i, 560.

L.

Labourasse, G. See P. Petit.
 Lachman, A., i, 542; ii, 593.
 Lacroix, A., ii, 604.
 Lam, A., ii, 634.
 Laurent, J. See É. Bourquelot.
 Leonardi, G. See A. Peratoner.
 Letts, E. A., and R. F. Blake, ii, 622.
 Levene, P. A., i, 572.
 Levinstein, E. See E. Baur.
 Lintner, C. J., ii, 631.
 Loeb, J., ii, 608.
 Loewi, O., ii, 636.
 Loiseleur, H., i, 542.
 Lord, E. C. E., ii, 603.
 Luck, A., and C. F. Cross, i, 541.
 Lunge, G., and J. Akunoff, i, 543.
 Lunt, J., ii, 585.

M.

Mabery, C. F. [with E. J. Hudson,
 S. Takano, W. O. Quayle], i, 533.
 Macfadyen, A., and S. Rowland,
 ii, 610.
 McIlhiney, P. C., ii, 633.
 McLennan, J. C., ii, 587.
 Magnier de la Source, L., ii, 620.
 Mainini, C. See V. Grandis.
 Manley, J. J., ii, 619.
 Marfori, P., i, 553.
 Marten, G., ii, 589.
 Mascetti, E., i, 541.
 Mawrow, F., ii, 596.
 Meine, W. See J. Troeger.
 Meldola, R., and L. Eynon, TRANS.,
 1159.
 Meldola, R., and E. Wechsler,
 TRANS., 1172.
 Melikoff, P. G., i, 536.
 Mendel, L. B., and H. C. Jackson,
 ii, 607.
 Mennicke, H., ii, 621.
 Meunier, L., i, 571.
 Meyer, R. J., and R. Jacoby, ii, 597.

Minssen, H., and B. Tacke, ii, 618.
 Mitchell, F. H. See A. Rogers.
 Mitchell, L. See H. L. Wheeler.
 Moore, F. J., i, 550.
 Morgan, G. T., TRANS., 1202, 1210.
 Morgan, J. L. R., and W. A. Duff,
 ii, 588.
 Morrell, R. S., and J. M. Crofts,
 TRANS., 1219.
 Morse, H. N., and D. W. Horn, ii, 626.
 Mosso, U., ii, 605.
 Münch, A., ii, 607.
 Muthmann, W., and E. Baur, ii, 597.

N.

Nastukoff, A., i, 540.
 Neuberg, C., i, 539.
 Niebel, W., i, 540.
 North, H. A. See H. L. Wheeler.

O.

Ochsner de Coninck, W., i, 535.
 Oenslager, G. See H. B. Hill.
 Oker-Blom, M., ii, 607.
 Oliveri-Tortorici, R., i, 552, 553.
 Ortoleva, G., i, 558.
 Orton, K. J. P. See F. D. Chattaway.
 Osborne, T. B., and G. F. Campbell,
 i, 573, 574.
 Ostwald, W., ii, 592.

P.

Palladin, W., ii, 612.
 Pannertz, F., ii, 621.
 Panormoff, A. A., i, 571.
 Pappada, N. See G. Bruni.
 Partheil, A., and J. von Velsen,
 ii, 633.
 Peckham, S. F. See O. H. Klein.
 Penfield, S. L., ii, 602.
 Peratoner, A., and G. Leonardi,
 i, 550, 551.
 Pesci, L., i, 546.
 Petit, P., and G. Labourasse, ii, 611.
 Pfeiffer, P., i, 559.
 Piccinini, A., and L. Salmoni, i, 562.
 Plancher, G. [with A. Bonavia],
 i, 560.
 Plancher, G. [with G. Testoni],
 i, 562.
 Poduschka, R., ii, 636.

Pomeranz, O., i, 552.
 Power, F. B., and F. Shedden, ii, 628.
 Prior, E., and D. Wiegmann, i, 541.
 Prior, G. T., ii, 602.
 Prior, G. T. See also E. Hussak.
 Proscher, F., i, 571.
 Puccianti, L., ii, 585.

Q.

Quayle, W. O. See C. F. Mabery.

R.

Ransom, F., ii, 608.
 Ransome, F. L. See W. F. Hillebrand.
 Rayleigh, Lord, ii, 589, 590.
 Remington, J. S. See C. F. Cross.
 Richter, R. See H. Thiele.
 Rimini, E., i, 554, 555.
 Rogers, A., and F. H. Mitchell, ii, 597.
 Roth, W. A., ii, 590.
 Rowland, S. See A. Macfadyen.
 Rudolph, P. See W. Autenrieth.
 Ruff, O. See E. Fischer.
 Ruhemann, R., and H. E. Stapleton, *TRANS*, 1179.
 Rung, F. See A. Binz.
 Rupp, E., ii, 628.

S.

Sabatier, P., and J. B. Senderens, i, 584.
 Sabbatani, L., i, 536.
 Salaskin, S., and J. Zaleski, ii, 607.
 Salfeld, A. See B. Tacke.
 Salkowski, E., ii, 635.
 Salmoni, L. See A. Piccinini.
 Sanders, W. M. See H. L. Wheeler.
 Sani, G., ii, 613.
 Sarthou, J., i, 575.
 Scherbatscheff, D., ii, 622.
 Schloesing, T., ii, 618.
 Schmidt, O. See E. Bamberger.
 Scholtz, M., ii, 638.
 Schoorl, N., ii, 625.
 Schulze, E., ii, 612.
 Senderens, J. B. See P. Sabatier.
 Shedden, F. See F. B. Power.
 Silberrad, O., *TRANS*, 1185.
 Sjollem, B., ii, 613.
 Smiles, S., *TRANS*, 1174.

Soch, C. A. See H. B. Hill.
 Solly, R. H., and H. Jackson, ii, 599.
 Spezia, G., ii, 595.
 Springer, L. See G. von Georgievics.
 Stapleton, H. E. See S. Ruhemann.
 Stern, M. See A. Tafel.
 Stenz, A. See R. von Walther.
 Stoklasa, J., ii, 610.
 Stolle, F., ii, 614.
 Stroppa, C. See D. Vitali.
 Sulc, O., ii, 595.

T.

Tacke, B., H. Immendorff, A. Salfeld, and F. Wolff, ii, 616.
 Tacke, B. See also H. Immendorff, H. Minssen.
 Täuber, E., and F. Walder, i, 566.
 Tafel, J., ii, 588.
 Tafel, J., and M. Stern, i, 557.
 Takano, S. See C. F. Mabery.
 Taylor, A. E., ii, 606.
 Testoni, G. See G. Plancher.
 Thiele, H., and R. Richter, ii, 620.
 Thudichum, J. L. W., ii, 609.
 Tingle, A., i, 544.
 Troeger, J., and W. Meine, ii, 635.
 Tutton, A. E., ii, 593.

V.

Vanbel, W., i, 544; ii, 590.
 Velsen, J. von. See A. Partheil.
 Vignier, ii, 608.
 Vitali, D., and C. Stroppa, ii, 639.

W.

Wagner, G., and W. Brykner, i, 554.
 Walder, F. See E. Täuber.
 Walther, R. von, and A. Stenz, i, 569.
 Washington, H. S., ii, 598.
 Waterhouse, J., ii, 585.
 Wechsler, E. See R. Meldola.
 Wenzel, G., i, 536.
 Wheeler, H. L., and B. Baynes [with W. H. Buell, G. K. Dustin, H. Le B. Gray, L. Mitchell, and H. A. North], i, 564.

- | | |
|--|--|
| <p>Wheeler, H. L., and W. M. Sanders
 [with B. Baynes], i, 563.
 Wiegmann, D. See E. Prior.
 Williams, R., ii, 633.
 Windisch, R., ii, 614.
 Winkler, O., ii, 598.
 Wintrebert, L., i, 543.
 Wolff, F. See B. Tacke.</p> | <p style="text-align: right;">Z.</p> <p>Zahn, O., i, 549.
 Zaleski, J. See S. Salaskin.
 Zambonini, F., ii, 603.
 Zeleny, J., ii, 587.
 Zincke, T., i, 545.
 Zulkowski, K., ii, 595.
 Zunino, V., i, 535.</p> |
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ERRATA.

VOL. LXXVIII. (ABSTR., 1900).

PART I.

Page	Line	
443	8*, 4*, 3*	} for "lactone" read "anhydride."
444	3, 2*	
535	15	
		,, "or Trimethylene" read "on Trimethylene."

PART II.

461	18	for "Methyl Acetate" read "Ethyl Ether."
461	28	,, "ethyl acetate" read "ethyl ether."
474	13	,, "60°" read "- 60°."
540	11*, 9*	,, "Hg ₂ K" read "Hg ₂ Na."
540	10*	,, "Hg ₂ K" ,, "Hg ₂ Na."

* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
CXV.—Action of Hydrogen Peroxide on Carbohydrates in the Presence of Ferrous Salts. II. By ROBERT SELBY MORRELL, M.A., Ph.D., and JAMES MURRAY CROFTS, M.A., B.Sc. (<i>Continued</i>)	1221
CXVI.—The Hydroxyphenoxy- and Phenylenedioxy-acetic Acids. By W. CARTER and W. TREVOR LAWRENCE, B.A., Ph.D.	1222
CXVII.—Specific Gravities of the Halogens at their Boiling Points, and of Oxygen and Nitrogen. By JULIEN DRUGMAN, Ph.D., and WILLIAM RAMSAY, F.R.S.	1228
CXVIII.—Hydroferrocyanic Acid. By KENDALL COLIN BROWNING, B.A.	1233
CXIX.—The Nature of Metal-ammonia Compounds in Aqueous Solution. Part I. By H. M. DAWSON and J. McCRAE	1239

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry

KRAFFT (FRIEDRICH). Configuration and Classification of Aliphatic Compounds	i, 577
MABEY (CHARLES F.) and D. M. BUCK. Hydrocarbons in Heavy Texas Petroleum	i, 577
STRÖM (KNUT T.). Norwegian Tar	i, 577
MOUNEYRAT (ANTOINE). General Method for the Preparation of Halogen Derivatives of Aliphatic Hydrocarbons	i, 577

	PAGE
DONV-HÉNAULT (OCTAVE). Electrolytic Syntheses of Organic Substances. II. (Iodoform)	i, 577
AUGER (VICTOR). New Method for the Preparation of Nitromethanes	i, 578
MARKOWNIKOFF (WLADIMIR B.) and WLADIMIR TSCHERDINTSEFF [and in part EFIMOFF]. Tertiary Derivatives of Heptanaphthene [Methylcyclohexane]	i, 578
MARKOWNIKOFF (WLADIMIR B.). Secondary Derivatives of Heptanaphthene [Methylcyclohexane]	i, 579
BAMBERGER (MAX) and ANTON LANDSIEDL. Erythritol in <i>Trentepohlia Jolithus</i>	i, 579
CAVALIERE (JACQUES) and EUGÈNE PROST. Some Phosphoric Esters	i, 579
BÉHAL (AUGUSTE). Mixed Anhydrides of Formic Acid	i, 580
FREUNDLICH (J.) and OTTO ROSAUER. Reduction of Oleic to Stearic Acid by the Aid of Nascent Hydrogen	i, 581
BLANC (G.). Campholytic and <i>iso</i> Lauronic Acids	i, 581
BOETTINGER (CARL). Glycollic and Glyoxylic Acids	i, 582
PERDRIX (LÉON). Oxidation of Dibasic Acids of the Aliphatic Series by Acid Potassium Permanganate	i, 582
WOLFF (LUDWIG). Substitution Products of Tetronic Acid	i, 582
WOLFF (LUDWIG) and A. LÜTTINGHAUS. Nitrotetronic Acid, Amino-tetronic Acid, and their Derivatives	i, 583
WOLFF (LUDWIG) and A. LÜTTINGHAUS. Phenylhydrazones of Diketobutyrolactone	i, 584
WOLFF (LUDWIG) and WILLY HEROLD. Behaviour of α -Methyltetronic Acid towards Diazobenzene Chloride	i, 585
WOLFF (LUDWIG) and EDUARD FERTIG. Iodotetronic Acid and Sulphotetronic Acid	i, 585
BLANC (G.). Action of Aluminium Chloride on Camphoric Anhydride	i, 586
MICHAILENKO (JAKOV I.) and W. P. JAVORSKY. Action of Zinc on a Mixture of Ethyl Bromoisobutyrate and Ethyl Formate. II. Action of Hydriodic, Hydrobromic, and Sulphuric Acids on β -Hydroxy- α -tetramethylglutaric Acid	i, 586
OLIVERI-TORTORICI (RICCARDO). Researches in the Pyrone Group. VIII. Diethyl Comenate	i, 587
TOWER (OLIN F.). [Tartrates of Nickel and Cobalt]	i, 587
PONZIO (GIACOMO). Conversion of Ketones into α -Diketones. V. <i>iso</i> Propyl <i>iso</i> Butyl Ketones	i, 588
PONZIO (GIACOMO). Acetyldioximes of α -Diketones	i, 588
KOENIGS (WILHELM) and EDUARD KNORR. Derivatives of Dextrose	i, 588
VIGNON (LÉO). Nitrocelluloses	i, 589
PETIT (PAUL). Dextrins of Saccharification	i, 589
LOOQUIN (R.). Action of Hexamethylenetetramine on the Esters of Chloroacetic and Bromoacetic Acids	i, 589
WALLACH (OTTO) [and in part L. OTTEMANN]. Terpenes and Ethereal Oils: Ring Disruption among Cyclic Ketones	i, 589
HIS (jun.) and PAUL. Behaviour and Reactions of Uric Acid and its Salts in Solutions	i, 591
HOFMANN (KARL A.). Pentacyano-iron Compounds	i, 591
ECHSNER DE CONINCK (WILLIAM). Isomerism in the Aromatic Series	i, 592
ORTOLEVA (GIOVANNI). Preparation of Iodoso- and Iodoxy-derivatives	i, 592
HABER (FRITZ). Electrolytic Reduction of Nitro-compounds	i, 592
ZALOZIECKI (ROMAN) and LUDWIG GANS. Hydrocarbons with High Melting Points from the Last Distillates of Petroleum	i, 593
FRIEDL (ARTHUR). Amino-derivatives of Methylphloroglucinol	i, 593
RICHARD (E.). Compounds of Bismuth with Phenols	i, 593
BORSCHKE (WALTER). Action of Benzenediazonium Chloride on Alkaline Solutions of Nitrosophenol	i, 594
AUGER (VICTOR). Diphenylmethyl Oxide	i, 594
HERZIG (JOSEF), JACQUES POLLAK, and KARL ROHM. Bromo-derivatives of the Homologous Phloroglucinols	i, 596

	PAGE
DELAGE (MARCEL). Pyrogallolsulphonic Acids	i, 595
WALBAUM (HEINRICH). Occurrence of Methyl Methylantranilate in Oil of Mandarins	i, 595
SCHULTZE (ALBERT). Benzoyl Derivatives of Amino-acids formed by the Fission of Proteids	i, 595
MASELLI (C.). Synthesis of Hydroxymethyl- <i>o</i> -benzoicsulphinide	i, 596
MAZZARA (GIROLAMO) and V. BERTOZZI. 2-Chloro-3-hydroxybenzoic and 2:6-Dichloro-3-hydroxybenzoic Acids	i, 596
WISLICIENUS (WILHELM). Isomerism of the Formylphenylacetic Esters	i, 597
GRIGOROWITSCH (P.). Synthesis of β - <i>p</i> -isoPropylphenyl- α -methylhydracrylic Acid	i, 597
SEVERIN (ÉMILE). Products of Condensation of Dichlorophthalic Anhydride with Diethylaniline	i, 598
LIMPRICHT (HEINRICH). <i>p</i> -Toluoyle- <i>p</i> -benzoic Acid and <i>pp</i> -Benzophenone-dicarboxylic Acid	i, 598
LIMPRICHT (HEINRICH). <i>o</i> -Xylophthaloylic Acid and Phthaloylphthalic Acid	i, 599
LIMPRICHT (HEINRICH). <i>p</i> -Toluoyle- β -propionic Acid	i, 600
MASSOL (GUSTAV). Thermal Study of Protocatechuic or 3:4-Dihydroxybenzoic Acid. Influence of Phenolic Hydroxyl	i, 600
RUSSIG (FRIEDRICH). Orthocarboxylic Acids and other Derivatives of 1:2- and 1:4-Dihydroxynaphthalene	i, 601
RAIKOW (P. N.). Double Compounds of Aromatic Aldehydes and Esters with Orthophosphoric Acid	i, 602
FROBENIUS (AUG. LUDWIG). Vanillin in Vinegar-essences	i, 603
DELAURE (MAURICE). Synthesis of Benzene by the Action of Zinc Ethyl on Acetophenone	i, 603
DELAURE (MAURICE). Gradual Synthesis of the Benzene Ring	i, 603
GESCHÉ (LOUIS). Action of Potassium Hydroxide on Dypnone	i, 604
KONDAKOFF (IWAN L.) and E. LUTSCHININ. Isomerism in the Menthol Series. III.	i, 604
SODEN (HUGO VON) and WILHELM ROFAHN. Sesquiterpene of Oil of Ginger	i, 605
BAMBERGER (MAX) and EMIL VISCHNER. Natural Resins [Ueberwallungsharze]. VI. Dry Distillation of Lariciresinol	i, 605
SKRAUP (ZDENKO HANNS) [and in part H. COPONY and G. MEDANICH]. Constitution of β -isoCinchonine	i, 605
SKRAUP (ZDENKO H.) and RUD. ZWERGER. α - and β -isoCinchonine	i, 606
WULFF (G. F.). Oxidation Products of Cotarnine	i, 607
RAUWERDA (A.). Cytisine and its Alkyl Derivatives	i, 607
SCHWANTKE (ARTHUR). Crystalline Form of Histidine Dichloride	i, 608
COHN (GEORG). Tetramethyldiaminodiphenylmethane and similar Substances	i, 608
BOGERT (MARSTON TAYLOR) and AUGUST HENRY GOTTHELF. Direct Synthesis of Ketodihydroquinazolines from Orthoamino-acids	i, 608
RÜGHEIMER (LEOPOLD). Constitution of Hippuroflavin	i, 609
RÜGHEIMER (LEOPOLD) and F. FEHLHABER. Homologues of Hippuroflavin	i, 609
WILLGERODT (CONRAD). Derivation and Rational Nomenclature of the Quinopyridines	i, 610
CHARDIN (D. A.). Formation of Safranines	i, 610
CURTIS (THEODOR) [and in part with E. HAAGER, E. HARDING, A. PROFFE, and G. SPRENGER]. Reduction of Aromatic Aldazines. Synthesis of Benzylhydrazine	i, 610
SEYEWETZ (ALPHONSE). Combination of Magenta with the Sulpho-conjugated Azo-colouring Matters	i, 614
VAUBEL (WILHELM). Isomeric Forms of Diazoaminobenzenedi- <i>p</i> -sulphonic Acid	i, 615
SPIRO (KARL). Influence of Nitrogenous Substances on the Heat-coagulation of Proteids	i, 615
MAGNUS-LEVY (ADOLF). Bence-Jones Albumin	i, 615

	PAGE
OSBORNE (THOMAS BURE) and GEORGE F. CAMPBELL. Proteids of the Egg Yolk	i, 616
FERNBACH (AUG.) and L. HUBERT. Influence of Phosphates and other Inorganic Compounds on the Proteolytic Diastase of Malt	i, 616

PART II.

General and Physical Chemistry.

RUNGE (CARL). Spectrum of Radium	ii, 641
STREINTZ (FRANZ). Electrical Conductivity of Compressed Powders	ii, 641
NEERNST (WALTHER) and F. DOLEZALEK. Gaseous Polarisation in the Lead Accumulator	ii, 641
STRASSER and GAHL. Gaseous Polarisation in the Lead Accumulator	ii, 642
IMMERWAHR (CL.). Potentials of Copper Electrodes in Solutions. Copper Precipitates of importance in Analysis	ii, 642
CEOTOGINO (F.). Oxidation Potentials	ii, 642
MÜLLER (ERICH). The Discharge Potential of Chlorine Ions	ii, 643
KENDRICK (ARTHUR). Migration Constant of Sulphuric Acid	ii, 643
MÜLLER (ERICH). Apparatus for Illustrating the Migration and Separation of Ions	ii, 643
DONY-HÉNAULT (OCTAVE). Electro-synthesis of Organic Substances	ii, 644
QUINCKE (FRIEDRICH). Electrolysis of Fused Salts	ii, 644
LORENZ (RICHARD). Electrolysis of Fused Salts	ii, 644
FOERSTER (FRITZ) and H. SONNEBORN. Evolution of Oxygen at the Anode in the Electrolysis of Solutions of Alkali Chlorides	ii, 645
FRANKLIN (EDWARD C.) and CHARLES A. KRAUS. Conductivity Temperature Coefficient of some Liquid Ammonia Solutions	ii, 645
LE CHATELIER (HENRI). Propagation of Condensation Waves in Heated Gases	ii, 645
HOUBEN (JOSEPH). Apparatus for Melting Point Determinations	ii, 645
CAUBET (F.). Liquefaction of Gaseous Mixtures	ii, 646
LEVI (M. G.). Dissociation in Colloidal Solutions	ii, 646
KAHLENBERG (LOUIS). Relation of the Taste of Acid Salts to their Degree of Dissociation. II.	ii, 646
TOUREN (CHARLES). Solubility of a Mixture of Salts having one Common Ion	ii, 646
BERTHELOT (DANIEL). Law of Corresponding States	ii, 646
LE CHATELIER (HENRI). Development and Propagation of an Explosive Wave	ii, 647
CARRARA (GIACOMO) and G. B. VESPIGNANI. Energy of some Metallic Hydroxides deduced from the Hydrolysis of their Salts	ii, 647
BRUNER (LOUIS). Chemical Dynamics. Dynamical Observations on the Bromination of Benzene	ii, 647
BRUNER (LOUIS) and STANISLAW TOLLOECKO. Velocity of the Formation of Esters from Benzoyl Chloride and Aliphatic Alcohols	ii, 648
RAIKOW (P. N.). Lecture Experiments for Demonstrating Fractional Distillation	ii, 648
HILL (EDWIN A.). System of Indexing Chemical Literature; Adopted by the Classification Division of the U.S. Patent Office	ii, 648

Inorganic Chemistry.

	PAGE
LANGE (A.). Some Properties of Liquid Chlorine	ii, 649
CLAUDE (GEORGES). Extraction of Oxygen from Air by Dissolution at a Low Temperature	ii, 649
HINRICHS (GUSTAVUS). Composition of the Air at Various Altitudes	ii, 649
VOLHARD (JAKOB). Action of Iodides and Hydriodic Acid on Sulphur Dioxide	ii, 650
VAUBEL (WILHELM). Relationship between Reactivity and Concentration of Sulphuric Acid	ii, 650
SAUNDERS (A. P.). Allotropic Forms of Selenium	ii, 650
PERATONER (ALBERTO) and GIUSEPPE ODDO. Electrolysis of Azoimide	ii, 651
MCDUGALL (ARTHUR) and FRED HOWLES. Production of Nitric Acid from Air by Means of the Electric Flame	ii, 651
FITTICA (FRIEDRICH). Alleged Conversion of Phosphorus into Arsenic and into Antimony	ii, 651
KNORRE (GEORG VON). Metaphosphates	ii, 651
PÉLABON (H.). Action of Hydrogen on the Sulphides of Arsenic	ii, 652
VILLARD (P.). Permeability of Molten Silica to Hydrogen	ii, 652
ROSENHEIM (ARTHUR) and SIEGFRIED STEINHÄUSER. Double Thiosulphates and Sulphites of the Alkali Metals, Silver, and Copper	ii, 652
ROSENHEIM (ARTHUR) and SIEGFRIED STEINHÄUSER. Double Salts of Ammonium Thiosulphate with Silver and Copper Haloids	ii, 653
ZULKOWSKI (KARL). Composition of Bottle Glasses	ii, 654
CURIE (SKŁODOWSKA). Atomic Weight of Radio-active Barium	ii, 654
BERTHELOT (DANIEL). Boiling Points of Zinc and Cadmium	ii, 654
DOBROSERDOFF (D.). Trihydrated Acid Cadmium Iodide	ii, 654
MEYER (RICHARD JOS.) [and in part C. WIEGAND]. Trivalent Thallium	ii, 655
KREP (WILHELM) and WILHELM BÖTTGER [and in part H. WINTER and H. IGGEN]. Amalgams	ii, 656
DEMARÇAY (EUGÈNE A.). New Spectra of the Rare Earths	ii, 656
KUTZNITZOFF (P.). Hydrates of Manganous Iodide	ii, 657
HEYN (E.). Osmond and Roberts-Austen's Theory of Iron-carbon Alloys	ii, 657
JOB (ANDRÉ). Oxidation of Salts of Cobalt and of Cerium in Alkaline Solution	ii, 657
DOBROSERDOFF (D.). Supposed Decomposition of Nickel Sulphate by Light	ii, 658
GUICHARD (MARCEL). The Blue Oxide of Molybdenum	ii, 658
LORDKIPANIDZÉ (S.). Fluoro-hyperuranium Compounds	ii, 658
HALL (ROBERT W.). Cause of the Loss in Weight of Commercial Platinum when heated under some Conditions	ii, 659
UHLENHUTH (RUDOLF). Platinum-Compounds of Hydroxylamine	ii, 659
ANTONY (UBALDO) and ALDO LUCCHESI. Ruthenium and its Compounds. III.	ii, 659
ROSENHEIM (ARTHUR). Osmium	ii, 660

Mineralogical Chemistry.

ELLIS (W. HODGSON) and WILLIAM LAWSON. Anthracite and Anthraxolite from Canada	ii, 660
MARKOWNIKOFF (WLADIMIR B.) [with K. BAILINSK]. Salt from Lake Djouvan-Tubé	ii, 660
CUMENGE (E.). Von-Diestite, a new Mineral	ii, 660
SCHIEBE (ROBERT). Löllingite from the Harz	ii, 661
NABL (ARNOLD). Colours of Minerals	ii, 661
GOODWIN (WILLIAM L.). Analyses of Corundum and Corundum-bearing Rock	ii, 661

	PAGE
D'ACHIARDI (GIOVANNI). Phosphorescent Dolomite from Elba . . .	ii, 661
PETERSEN (THEODOR). [Turquoise and Phosphorochalcite] . . .	ii, 661
GOODWIN (WILLIAM L.) and WILLET G. MILLER. A Mineral of the Columbite Group . . .	ii, 662
VIOLA (CARLO) and E. H. KRAUSS. Fedorowite . . .	ii, 662
PELIKAN (A.). Pyroxene from Moravia . . .	ii, 662
ZAMBONINI (FERBUCCIO). Pyroxene from Latium . . .	ii, 662
VIOLA (CARLO). Felspar Studies . . .	ii, 662
BEERMANN (HEINRICH). Composition of Tourmaline . . .	ii, 663
WRIGHT (FRED. EUG.). Alkali-syenite from Massachusetts . . .	ii, 663
MACLEOD (W. A.) and O. E. WHITE. New Variety of Garnet . . .	ii, 663
HACKMAN (VICTOR). [Ivaarite] . . .	ii, 664
COHEN (EMIL W.). Meteoric Irons . . .	ii, 664
DIESELDORFF (ARTHUR). Melonite from South Australia . . .	ii, 664

Physiological Chemistry.

HALDANE (JOHN S.) and J. LORRAIN SMITH. Mass and Oxygen Capacity of Blood in Man . . .	ii, 665
MARTIN (L. G. DE SAINT). Absorptive Power of Hæmoglobin for Oxygen and Carbon Monoxide . . .	ii, 665
HÉDON (E.). Agglutination of Blood Corpuscles by Chemical Agents . . .	ii, 665
MAGNUS (R.). Changes in the Composition of the Blood after Transfusion of Sodium Chloride, and their Relationship to Diuresis . . .	ii, 665
STASSANO (HENRI). Functions of the Nucleus in Relation to Hæmoglobin Formation and Cellular Protection . . .	ii, 666
HANFORD (G. A.). Influence of Acids on the Amyolytic Action of Saliva . . .	ii, 666
PFÄUNDLER (MEINHARD). End Products of Gastric Digestion . . .	ii, 666
SCHÜTZ (JULIUS). Quantitative Relationships of Pepsin Activity . . .	ii, 666
BLUM (LEON). Nutritive Value of Hetero-albumose from Fibrin, and Proto-albumose from Casein . . .	ii, 667
LÜHRIG (H.). Comparative Absorption [Digestibility] and Velocity of Hydrolysis of Certain Fats . . .	ii, 667
PFLÜGER (ÉDUARD). Absorption of Coloured Fats . . .	ii, 667
FRIEDENTHAL (HANS). Absorption of Fat . . .	ii, 668
HENRIQUES (V.) and C. HANSEN. Formation of Fat in the Animal Organism by Intensive Feeding of Fat . . .	ii, 668
ZUNTZ (NATHAN) and USSOW. Origin of Volatile Fatty Acids in Butter . . .	ii, 669
BLAUBERG (MAGNUS). Mineral Metabolism in the Naturally and Artificially Fed Infant . . .	ii, 669
KIROHMANN (JOSEPH). Proteid-Metabolism during Gelatin-Feeding . . .	ii, 669
KRUMMACHER (OTTO). Influence of Sodium Chloride Solution Injected Subcutaneously on Proteid Metabolism . . .	ii, 670
GOODBODY (FRANCIS W.). Influence of Sodium Salicylate on Metabolism . . .	ii, 670
GAUTIER (ARMAND). <i>Rôle</i> of Arsenic in Connection with the Menstrual Flow . . .	ii, 670
BOURET (PAUL). Metabolism of Iodine . . .	ii, 670
NAKASEKO (R.). Glycogen Formation after Inulin Feeding . . .	ii, 670
MOORE (BENJAMIN) and WILLIAM H. PARKER. Formation of Lactose . . .	ii, 671
GOODMAN (J. H.). Connective Tissue in Muscle . . .	ii, 671
BARBIERI (N. ALBERTO). Chemistry of the Brain . . .	ii, 671
SUIFFET (TH.). Thyroid Gland of Sheep . . .	ii, 671
JACOBY (MARTIN). Fermentative Decomposition of Proteid, and Ammonia Formation in the Liver. Changes in the Liver during Phosphorus Poisoning, and their relation to Autolysis . . .	ii, 671
PANZER (THEODOR). Human Chyle . . .	ii, 672
ASHER (LEON) and WILLIAM J. GIES. Properties and Formation of Lymph . . .	ii, 673
CORLETTE (CYRIL). Excretion in the Small Intestine . . .	ii, 673

CAMUS (L.) and EUGÈNE GLEY. Action of the Liquid of the External Prostate on the Liquid of the <i>Vesiculæ Seminales</i>	ii, 673
CAMUS (L.) and EUGÈNE GLEY. Properties of the Secretion of the Internal Prostate of the Hedgehog	ii, 674
LONG (JOHN H.). Peculiarities in the Urine of Vegetarians	ii, 674
PFAUNDLER (MEINHARD). Estimation of Amino-acid Nitrogen in Urine	ii, 674
PETRY (EUGEN). Loosely Combined Sulphur in the Urine	ii, 675
ZÄNGERLE. Pseudomucin from Ovarian Cysts	ii, 675
RUSCHHAUPT (WALTER). Acetone Glycosuria	ii, 675
DELEZENNE (C.). Antihepatic Serum	ii, 675
HILDEBRANDT (HERMANN). Syntheses in the Animal Organism. I. Piperidine Derivatives	ii, 676
VÁMOSSY (ZOLTÁN VON). May Phenolphthalein be safely added to Marc Wines?	ii, 676
DIXON (WALTER E.). Physiological Action of Pöehl's Spermine	ii, 676
DEUBURG (JOHN VAN) and OTIS B. WIGHT. Physiological Action of the Poisonous Secretion of the Gila Monster	ii, 677
MENDEL (LAFAYETTE B.). Iodine in Corals	ii, 677
GRIFFITHS (ARTHUR B.). Colouring Matter of <i>Echinus esculentus</i>	ii, 677

Chemistry of Vegetable Physiology and Agriculture.

MALFITANO (G.). Bacteriolysis of the <i>Bacillus anthracis</i>	ii, 677
PENNINGTON (MARY E.) and GEORGE C. KÜSEL. Gas-producing Power of <i>Bacillus coli communis</i> under different conditions of Environment	ii, 678
DUCLAUX (ÉMILE). Physiology of Yeast	ii, 678
REY-PAILLHADE (JOSEPH DE). Chemical Fermentation by Yeast in an Antiseptic Medium	ii, 678
MAQUENNE (LÉON). Germination	ii, 678
FRIEDEL (JEAN). Influence of Pressure on Chlorophyllous Assimilation	ii, 679
GRIFFITHS (ARTHUR B.). Ashes of some Medicinal Plants	ii, 679
POSTERNAK. Phosphorus Compound first formed in Chlorophyllous Plants. Physiological Role of Inositol	ii, 679
ANDRLIK (KARL). Citric Acid in Saturation-Sludge	ii, 679
BEHRENS (JOHANNES). Presence of Vanillin in Vanilla	ii, 679
PETIT (PAUL) and G. LABOURASSE. Nitrogenous Substances in Malt	ii, 680
SURIN (J. J.). Milky Juice of <i>Hura crepitans</i>	ii, 680
CUNIASSE (L.). Analyses of Marine Algae	ii, 680
DEHÉRAU (PIERRE P.). Experiments at Grignon	ii, 680
HOPPE (PAUL). Value of Molasses as Food	ii, 681
STROHMER (FRIEDRICH). Blood Molasses	ii, 681
LILIENTHAL. Feeding Pigs with Blood Molasses	ii, 682
WOY (RUDOLF). Peat-meal Molasses	ii, 682
VIETH (PAUL). Feeding Experiments with Crushed Palm Kernels	ii, 682
TACKE (BRUNO) and BERNHARD TOLLENS. Composition of Various Kinds of Peat	ii, 682
TACKE (BRUNO), HEINRICH IMMENDORFF, and H. MINSEN. Composition of Drainage from Unmanured and Manured Peat Soil, with special reference to Nitrogen Compounds	ii, 683
WISSELL (L. VON). Changes in the Weights of Artificial Manures when Exposed to Air	ii, 683
WOLLNY (EWALD). Manurial Experiments with Green and Dead Plants and Parts of Plants	ii, 683
STOKLASA (JULIUS), F. DUCHÁZEK, and J. PITRA. Influence of Bacteria on the Decomposition of Bones	ii, 684
BÖRNTÄGER (HUGO). Infected Phosphates	ii, 684

Analytical Chemistry.

	PAGE
KREITLING. Employment of Floats in Burettes	ii, 685
CROTOGINO (F.). [Electrometric Estimation of Iodine]	ii, 685
REICHHARD (C.). Detection of Iodic Acid in the Presence of Chloric Acid, Bromic Acid, Perchloric Acid, and Periodic Acid by means of Morphine Sulphate	ii, 685
WESTON (ROBERT SPURR). Apparatus for the Determination of Ammonia in Water by the Wanklyn Method, and Total Nitrogen by the Kjeldahl Method	ii, 685
WISSEL (L. VON). Comparative Estimations of Nitrogen in Saltpetre	ii, 685
GAILLAT (J.). Gasometric Method of Estimating Nitrites in Presence of Nitrates or other Soluble Salts	ii, 686
GOOCH (FRANK A.) and JULIA C. MORRIS. Iodometric Estimation of Arsenic Acid	ii, 686
DIVINE (R. E.). Process for the Estimation of Carbon Dioxide in Carbonates	ii, 686
FORMÁNEK (JULIUS). Detection of Metals by the Absorption Spectra of their Compounds with Alkanna	ii, 687
HENRIQUES (ROBERT) and OTTO MAYER. Estimation of Total and Free Alkali and Alkali Carbonate in Soaps	ii, 687
HESS (WILLIAM H.). Method for the Rapid Gravimetric Estimation of Calcium	ii, 688
MILLER (EDMUND H.) and E. J. HALL. Titration of Zinc with Potassium Ferrocyanide	ii, 688
BALACHOWSKI (DMITRI). Electrolytic Estimation of Cadmium	ii, 688
FAKTOR (FRANZ). Action of Sodium Thiosulphate on Lead Salts	ii, 688
MENNICKE (H.). Analyses of Lead and Tin Ores, also of the most Important Lead and Tin Preparations and their Commercial Products	ii, 688
BORNTRÄGER (HUGO). Analysis of Phosphor-copper	ii, 689
NORTON (JOHN T., jun.). Titration of Mercury by Sodium Thiosulphate	ii, 689
FARUP (P.). Simple and Accurate Method for the Estimation of Mercury in Urine	ii, 689
WERDER (J.). Estimation of Mercury in Urine	ii, 689
BALDY (F.). Examination of Aluminium and Zinc by Solution in Hydrochloric Acid	ii, 690
MIGNOT (ANDRÉ). Volumetric Estimation of Manganese in Pig-iron, Cast-iron, and Steel	ii, 690
TOWER (OLIN F.). Precipitation of the Sulphides of Nickel and Cobalt in an Alkaline Tartrate Solution	ii, 690
FAKTOR (FRANZ). Action of Sodium Thiosulphate on Certain Metallic Salts, and its Employment in Quantitative Analysis	ii, 691
REICHHARD (C.). Volumetric Estimation of Chromic Acid by Arsenious Acid in an Alkaline Solution	ii, 691
DÖHLER (E.). Estimation of Molybdenum in Iron	ii, 691
BORNTRÄGER (HUGO). Rapid Assay of Tungsten Ores and Residues	ii, 692
FAKTOR (FRANZ). Action of Sodium Thiosulphate on Bismuthic, Ferrous, and Ferrio Salts	ii, 692
OST (HERMANN) and W. KLAPPROTH. Electrolytic Precipitation of Antimony from its Sulpho-salt with the Application of a Diaphragm	ii, 692
CHAPMAN (ALFRED C.) and HERBERT E. BURGESS. Improved Absorption Apparatus for use in the Analysis of Essential Oils	ii, 693
RASCHIG (FRITZ). Estimation of <i>m</i> -Cresol in Mixtures of Cresols	ii, 694
JEAN (FERDINAND). Estimation of Glycerol in Fats and Soaps	ii, 694
HALPHEN (GEORGES). Analysis of Saccharine Liquids	ii, 694
KOVÁČ (JOHANN). Estimation of Sugar in Beet	ii, 694
WOY (RUDOLF). [Estimation of Sugar in] Peat-meal Molasses	ii, 695
ROQUES (XAVIER). Polarimetric Estimation of Sugar in Wine	ii, 695
LANGKOPF (OTTO). Detection of Salicylic Acid in the Presence of Citric Acid	ii, 695

	PAGE
FERREIRA DA SILVA (ANTONIO J.). A Cause of Error in Testing for Salicylic Acid in Wines	ii, 695
BELLOCOQ (A.). Estimation of Uric Acid	ii, 695
JOLLES (ADOLF). Precipitation of Uric Acid by Barium Chloride	ii, 696
RICHMOND (HENRY DROOP). Composition of Milk and Milk Products	ii, 696
SIEBER (NADINA). Umikoff's Reaction with Human Milk.	ii, 696
FABER (HARALD). Composition of Danish Butter	ii, 696
WELMANS (P.). Welmans' Phosphomolybdate Test	ii, 697
SOLTSIEN (PAUL). Welmans' Reaction for the Detection of Vegetable Oils	ii, 697
VULTE (HERMANN T.) and HARRIET WINFIELD GIBSON. Chemistry of Corn Oil [Maize Oil]	ii, 697
RAIKOW (P. N.). Halphen's Colour Reaction for the Identification of Cotton Seed Oil	ii, 698
UTZ (F.). Sessamé Oil	ii, 699
LEONARD (NORMAN) and HARRY M. SMITH. Polarimetric Estimation of Camphor in Camphorated Oil	ii, 699
GARNIER (LÉON) and LÉOPOLD MICHEL. Influence of Dextrose on the Estimation of Urea by the Hypobromite Method	ii, 699
HALPHEN (GEORGES). Detection of Foreign Colouring Matters in Preserved Tomatoes	ii, 700
BOUMA (JACOB). Urinary Indican	ii, 700
ROMAN (TH.) and G. DELLUC. Detection of Urobilin in Urine	ii, 700

INDEX OF AUTHORS' NAMES.

A.

Andrlík, K., ii, 679.
 Antony, U., and A. Lucchesi,
 ii, 659.
 Asher, L., and W. J. Gies, ii, 678.
 Anger, V., i, 578, 594.

B.

Bailinsk, K. See W. Markownikoff.
 Balachowski, D., ii, 688.
 Baldry, F., ii, 690.
 Bamberger, M., and A. Landsiedl,
 i, 579.
 Bamberger, M., and E. Vischner,
 i, 608.
 Barbieri, N. A., ii, 671.
 Beermann, H., ii, 668.
 Béhal, A., i, 580.
 Behrens, J., ii, 679.
 Bellocq, A., ii, 695.
 Berthelot, D., ii, 646, 654.
 Bertozzi, V. See G. Mazzara.
 Blanc, G., i, 581, 586.
 Blauberg, M., ii, 669.
 Blum, L., ii, 667.
 Böttger, W. See W. Kerp.
 Boettinger, C., i, 582.
 Bogert, M. T., and A. H. Gotthelf,
 i, 608.
 Bornträger, H., ii, 684, 689, 692.
 Borsche, W., i, 594.
 Bouma, J., ii, 700.
 Bourcet, P., ii, 670.
 Browning, K. C., TRANS., 1233.
 Bruner, L., ii, 647.
 Bruner, L., and S. Tolloczko,
 ii, 648.
 Buck, D. M. See C. F. Mabery.
 Burgess, H. E. See A. C. Chapman.

C.

Campbell, G. F. See T. B. Osborne.
 Camus, L., and E. Gley, ii, 673, 674.
 Carrara, G. and G. B. Vespignani,
 ii, 647.
 Carter, W., and W. T. Lawrence,
 TRANS., 1222.
 Caubet, F., ii, 646.
 Cavalier, J., and E. Prost, i, 579.
 Chapman, A. C., and H. E. Burgess,
 ii, 693.
 Chardin, D. A., i, 610.
 Claude, G., ii, 649.
 Cohen, E. W., ii, 664.
 Cohn, G., i, 608.
 Copony, H. See Z. H. Skraup.
 Corlette, C., ii, 673.
 Crotogino, D., ii, 642, 685.
 Cumenge, E., ii, 660.
 Cuniasse, L., ii, 680.
 Curie, S., ii, 654.
 Curtius, T. [E. Haager, E. Harding,
 A. Propfe, and G. Sprenger],
 i, 610.

D.

D'Achiardi, G., ii, 661.
 Dawson, H. M., and J. McCrae,
 TRANS., 1239.
 Dehérain, P. P., ii, 680.
 Delacre, M., i, 603.
 Delage, M., i, 595.
 Delezenne, C., ii, 675.
 Delluc, G. See T. Roman.
 Demarçay, E., ii, 656.
 Deuberg, J. van, and O. B. Wright,
 ii, 677.
 Dieseldorff, A., ii, 664.
 Divine, R. E., ii, 686.
 Dixon, W. E., ii, 676.
 Dobroserdoff, D., ii, 654, 658.
 Döhler, E., ii, 691.
 Dolezalek, F. See W. Nernst.
 Dony-Hénault, O., i, 577; ii, 644.

Drugman, J., and W. Ramsay,
TRANS., 1228.
Ducháček, F. See J. Stoklasa.
Duclaux, E., ii, 678.

E

Efimoff. See W. B. Markownikoff.
Ellis, W. H., and W. Lawson, ii, 660.

F

Faber, H., ii, 696.
Faktor, F., ii, 688, 691, 692.
Farup, P., ii, 689.
Fehlhaber, F. See L. Rügheimer.
Fernbach, A., and L. Hubert, i, 616.
Ferreira da Silva, A. J., ii, 695.
Fertig, E. See L. Wolff.
Fittica, F., ii, 651.
Foerster, F., and H. Sonneborn,
ii, 645.
Formánek, J., ii, 687.
Franklin, E. C., and C. A. Kraus,
ii, 645.
Freundlich, J., and O. Rosauer,
i, 581.
Friedel, J., ii, 679.
Friedenthal, H., ii, 668.
Friedl, A., i, 593.
Frobenius, A. L., i, 603.

G

Gahl. See Strasser.
Gailhat, J., ii, 686.
Gana, L. See R. Zaloziecki.
Garnier, L., and L. Michel, ii, 699.
Gautier, A., ii, 670.
Gesché, L., i, 604.
Gibson, H. W. See H. Vulte.
Gies, W. J. See L. Asher.
Gley, R. See L. Camus.
Gooch, F. A., and J. C. Morris,
ii, 686.
Goodbody, F. W., ii, 670.
Goodman, J. H., ii, 671.
Goodwin, W. L., ii, 661.
Goodwin, W. L., and W. G. Miller,
ii, 662.
Gotthelf, A. H. See M. T. Bogert.
Griffiths, A. B., ii, 677, 679.
Grigorowitsch, P., i, 597.
Guichard, M., ii, 658.

H

Haager, E. See T. Curtius.
Haber, F., i, 592.

Hackman, V., ii, 664.
Haldane, J. S., and J. L. Smith,
ii, 665.
Hall, R. W., ii, 659.
Halphen, G., ii, 694, 700.
Hanford, G. A., ii, 666.
Hansen, C. See V. Henriques.
Harding, E. See T. Curtius.
Hédon, E., ii, 665.
Henriques, R., and O. Mayer,
ii, 687.
Henriques, V., and C. Hansen,
ii, 668.
Herold, W. See L. Wolff.
Herzig, J., J. Pollak, and K. Rohm,
i, 595.
Hess, W. H., ii, 688.
Heyn, E., ii, 657.
Hildebrandt, H., ii, 676.
Hill, E. A., ii, 648.
Hill, E. J. See E. H. Miller.
Hinrichs, G., ii, 649.
His, jun., and Paul, i, 591.
Hofmann, K. A., i, 591.
Hoppe, P., ii, 681.
Houben, J., ii, 645.
Howles, F. See A. McDougall.
Hubert, L. See A. Fernbach.

I

Iggena, H. See W. Kerp.
Immendorff, H. See B. Tacke.
Immerwarr, C., ii, 642.

J

Jacoby, M., ii, 671.
Javorsky, W. P. See J. I. Michailenko.
Jean, F., ii, 694.
Job, A., ii, 657.
Jolles, A., ii, 696.

K

Kahlenberg, L., ii, 646.
Kendrick, A., ii, 648.
Kerp, W., and W. Böttger [H. Iggena and H. Winter], ii, 656.
Kirchmann, J., ii, 669.
Klapproth, W. See H. Ost.
Knorr, E. See W. Koenigs.
Knorre, G. von, ii, 651.
Koenigs, W., and E. Knorr, i, 588.
Kondakoff, I. L., and E. Lutschinin, i, 604.
Kováč, J., ii, 694.

Krafft, F., i, 577.
 Kraus, C. A. See E. O. Franklin.
 Kraus, E. H. See C. Viola.
 Kreitling, ii, 685.
 Krummacher, O., ii, 670.
 Küsel, G. C. See M. E. Pennington.
 Kutznetzoff, P., ii, 657.

L.

Labourasse, G. See P. Petit.
 Landsiedl, A. See M. Bamberger.
 Lange, A., ii, 649.
 Langkopf, O., ii, 695.
 Lawrence, W. T. See W. Carter.
 Lawson, W. See W. H. Ellis.
 Le Chatelier, H., ii, 645, 647.
 Leonard, N., and H. M. Smith,
 ii, 699.
 Levi, M. G., ii, 646.
 Lilienthal, ii, 682.
 Limpricht, H., i, 598, 599, 600.
 Locquin, R., i, 589.
 Long, H. J., ii, 674.
 Lordkipanidzé, S., ii, 658.
 Lorenz, R., ii, 644.
 Lucchesi, A. See U. Antony.
 Lührig, H., ii, 667.
 Lüttringhaus, A. See L. Wolff.
 Lutschinin, E. See I. L. Kondakoff.

M.

Mabery, C. F., and D. M. Buck,
 i, 577.
 McCrae, J. See H. M. Dawson.
 McDougall, A., and F. Howles,
 ii, 651.
 Macleod, W. A., and O. E. White,
 ii, 663.
 Magnus, R., ii, 665.
 Magnus-Levy, A., i, 615.
 Malfitano, G., ii, 677.
 Maquenne, L., ii, 678.
 Markownikoff, W. B., i, 579.
 Markownikoff, W. B. [and K.
 Bailinsk], ii, 660.
 Markownikoff, W. B., and W.
 Tscherdintzeff [with Efimoff],
 i, 578.
 Maselli, C., i, 596.
 Massol, G., i, 600.
 Mayer, O. See R. Henriques.
 Mazzara, G., and V. Bertozzi, i, 596.
 Medanich, G. See Z. H. Skraup.
 Mendel, L. B., ii, 677.
 Mennicke, H., ii, 638.
 Meyer, R. J. [and O. Wiegand],
 ii, 655.

Michailenko, J. I., and W. P. Javorsky, i, 586.
 Michel, L. See L. Garnier.
 Mignot, A., ii, 690.
 Miller, E. H., and E. J. Hill, ii, 638.
 Miller, W. G. See W. L. Goodwin.
 Minssen, H. See B. Tacka.
 Moore, B., and W. H. Parker, ii, 671.
 Morris, J. C. See F. A. Gooch.
 Mouneyrat, A., i, 577.
 Müller, E., ii, 643.

N.

Nabl, A., ii, 661.
 Nakaseko, R., ii, 670.
 Nernst, W., and F. Dolezalek,
 ii, 641.
 Norton, J. T., jun., ii, 639

O.

Oddo, G. See A. Peratoner.
 Oechsner de Coninck, W., i, 592.
 Oliveri-Torticci, R., i, 587.
 Ortoleva, G., i, 592.
 Osborne, T. B., and G. F. Campbell,
 i, 616.
 Ost, H., and W. Klapproth, ii, 692.
 Ottemann, L. See O. Wallach.

P.

Panzer, T., ii, 672.
 Parker, W. H. See B. Moore.
 Paul. See His, jun.
 Pélabon, H., ii, 652.
 Pelikan, A., ii, 662.
 Pennington, M. E., and G. C. Küsel,
 ii, 678.
 Perdrix, L., i, 582.
 Petersen, T., ii, 661.
 Petit, P., i, 589.
 Petit, P., and G. Labourasse, ii, 680.
 Petry, E., ii, 675.
 Pfaundler, M., ii, 666, 674.
 Pflüger, E., ii, 667.
 Pitra, J. See J. Stoklasa.
 Pollak, J. See J. Herzig.
 Ponzio, C., i, 588.
 Posternak, ii, 679.
 Proppe, A. See T. Curtius.
 Prost, E. See J. Cavalier.

Q.

Quinke, F., ii, 644.

R.

Raikow, P. N., i, 602; ii, 648, 698.
 Ramsay, W. See J. Drugman.
 Raschig, F., ii, 694.
 Rauwerda, A., i, 607.
 Reichard, C., ii, 685, 691.
 Rey-Pailhade, J. de, ii, 678.
 Richard, E., i, 593.
 Richmond, H. D., ii, 696.
 Rocques, X., ii, 695.
 Rohm, K. See J. Herzig.
 Rojahn, W. See H. von Soden.
 Roman, T., and G. Delluc, ii, 700.
 Rosauer, O. See J. Freundlich.
 Rosenheim, A., ii, 660.
 Rosenheim, A., and S. Steinhäuser,
 ii, 652, 653.
 Rügheimer, L., i, 609.
 Rügheimer, L., and F. Fehlhaber,
 i, 609.
 Runge, G., ii, 641.
 Ruschhaupt, W., ii, 675.
 Russig, F., i, 601.

S.

Saint-Martin, L. G., ii, 665.
 Saunders, A. P., ii, 650.
 Scheibe, R., ii, 661.
 Schütz, H. J., ii, 666.
 Schultze, A., i, 595.
 Schwantke, A., i, 603.
 Severin, E., i, 598.
 Seyewetz, A., i, 614.
 Sieber, N., ii, 696.
 Skraup, Z. H. [H. Copony and G.
 Medanich], i, 605.
 Skraup, Z. H., and R. Zwerger, i, 606.
 Smith, H. M. See N. Leonard.
 Smith, J. L. See J. S. Haldane.
 Soden, H. von, and W. Rojahn, i, 605.
 Soltsien, P., ii, 697.
 Sonneborn, H. See F. Foerster.
 Sprenger, G. See T. Curtius.
 Spiro, K., i, 615.
 Stassano, H., ii, 666.
 Steinhäuser, S. See A. Rosenheim.
 Stoklasa, J., F. Ducháček, and J.
 Pitra, ii, 684.
 Strasser and Gahl, ii, 642.
 Streintz, F., ii, 641.
 Ström, K. T., i, 577.
 Strohmmer, F., ii, 681.
 Suiffet, T., ii, 671.
 Suria, J. J., ii, 680.

T.

Tacke, B., H. Immendorff, and H.
 Minssen, ii, 683.
 Tacke, B., and B. Tollens, ii, 682.

Tollens, B. See B. Tacke.
 Tolloczko, S. See L. Brunner.
 Touren, C., ii, 646.
 Tower, O. F., i, 587; ii, 690.
 Tscherdintzeff, W. See W. B.
 Markownikoff.

U.

Uhlenhuth, R., ii, 659.
 Usow. See N. Zuntz.
 Utz, F., ii, 699.

V.

Vamosy, Z. von, ii, 676.
 Vaubel, W., i, 615; ii, 650.
 Vespignani, G. B. See G. Carrara.
 Vieth, P., ii, 682.
 Vignon, L., i, 589.
 Villard, P., ii, 652.
 Viola, C., ii, 663.
 Viola, C., and E. H. Kraus, ii, 662.
 Vischner, E. See M. Bamberger.
 Volhard, J., ii, 650.
 Vulte, H. J., and H. W. Gibson,
 ii, 697.

W.

Walbaum, H., i, 595.
 Wallach, O. [and L. Ottemann],
 i, 589.
 Welmans, P., ii, 697.
 Werder, J., ii, 639.
 Weston, R. S., ii, 685.
 White, O. E. See W. A. Macleod.
 Wiegand, C. See R. J. Meyer.
 Willgerodt, C., i, 610.
 Winter, H. See W. Kerp.
 Wislicenus, W., i, 597.
 Wissell, L. von, ii, 683, 685.
 Wolff, L., i, 582.
 Wolff, L., and E. Fertig, i, 585.
 Wolff, L., and W. Herold, i, 585.
 Wolff, L., and A. Lüttringhaus,
 i, 583, 584.
 Wollny, E., ii, 683.
 Woy, R., ii, 682, 695.
 Wright, F. E., ii, 663.
 Wright, O. B. See J. van Denberg.
 Wulff, G. F., i, 607.

Z.

Zängerle, ii, 675.
 Zaloziecki, R., and L. Gans, i, 593.
 Zambonini, F., ii, 662.
 Zulkowski, K., ii, 654.
 Zuntz, N., and Usow, ii, 669.
 Zwerger, R. See Z. H. Skraup.

ERRATA.

VOL. LXXVII (TRANS., 1900).

Page	Line	
1206	10*	for "1-chloro-1 : 2-phenylenediamine" read "1-chloro-2 : 4-phenylenediamine."
1213	20	„ "loc. cit." read "Annalen, 1898, 302, 313."
1218	15	„ "C ₁₉ H ₁₅ ONCl" read "C ₁₉ H ₁₅ ON ₂ Cl."

VOL. LXXVIII. (ABSTR., 1900).

PART I.

578	17*	„ "TCHERDINTZEFF" read "TSCHERDINTZEFF."
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PART II.

657	top	„ "KUENETZOFF" read "KUTZNETZOFF."
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* From bottom.

CONTENTS.

PAPERS READ BEFORE THE CHEMICAL SOCIETY.

	PAGE
CXIX.—The Nature of Metal-ammonia Compounds in Aqueous Solution. Part I. By H. M. DAWSON and J. MCCRAE (Continued)	1261
CXX.—Action of Alkalis on the Nitro-compounds of the Paraffin Series. Part II. Reactions and Constitution of Methazonic Acid and the Mode of Formation of Isoxazoles. By WYNDHAM R. DUNSTAN, F.R.S., and ERNEST GOULDING, B.Sc.	1262
CXXI.—Amount of Chlorine in Rain Water collected at Cirencester. By EDWARD KINCH, Royal Agricultural College, Cirencester	1271
CXXII.—Hexachlorides of Benzonitrile, Benzamide, and Benzoic Acid. By FRANCIS EDWARD MATTHEWS	1273
Nilson Memorial Lecture. By OTTO PETTERSSON, Professor of Chemistry in the University of Stockholm	1277
CXXIII.—Degradation of Glycollic Aldehyde. By HENRY J. HORSTMAN FENTON, M.A., F.R.S.	1294
CXXIV.—Researches on the Alkyl-substituted Succinic Acids. Part III. Dissociation Constants. By WILLIAM A. BONE and CHARLES H. G. SPRANKLING	1298
CXXV.—Genistein. Part II. By ARTHUR GEORGE PERKIN, F.R.S.E., and LOUIS HUBERT HORSFALL	1310
CXXVI.—Luteolin. Part III. By ARTHUR GEORGE PERKIN, F.R.S.E., and LOUIS HUBERT HORSFALL	1314
CXXVII.—Contributions to the Knowledge of Fluorescent Compounds. Part I. The Nitro-derivatives of Fluorescein. By JOHN THEODORE HEWITT and BRYAN W. PERKINS	1324

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS:—

PART I.

Organic Chemistry

	PAGE
PONI (PETRU). Composition of Roumanian Petroleum	i, 617
RAEMER (GUSTAV) and ADOLF SPILKER. Decomposition of Viscous Substances (Lubricating Oils) by Distillation under Pressure	i, 617
MIXTER (WILLIAM G.). Products of the Explosion of Acetylene and of Mixtures of Acetylene and Nitrogen	i, 618
HANTZSCH (ARTHUR). History of the Isonitro-compounds 	i, 618
HOFMANN (KARL A.) and JULIUS SAND. Compounds of Ethylene and Allyl Alcohol with Mercuric Salts	i, 618
ALBERDA VAN EKENSTEIN (WILLIAM) and CORNELIS A. LOBBY DE BRUYN. Some New Derivatives belonging to the Sugar Group	i, 619
ULLMANN (FRITZ) and P. WENNER. Dimethyl Sulphate as an Alkylating Agent	i, 619
BERTHELOT (MARCELLIN P. E.). Decomposition of Alkyl Nitrates and Nitroglycerol by Alkalis, and the Relative Stability of Explosives	i, 620
KISSEL (J.). Reaction of Nitrous Esters with Alcohols and Ketones in Presence of Excess of Hydrogen Chloride [in Alcoholic Solutions]	i, 620
BERGELL (PETER). Preparation of Lecithin	i, 621
THOMS (HERMANN). Constituents of Cascarilla Oil, and Undecenoic Acid	i, 622
NOYES (WILLIAM A.) and EDWARD F. PHILLIPS. Camphoric Acid. IX. Structure and Configuration of <i>cis-trans</i> -Campholytic Acid	i, 622
DIECKMANN (WILHELM). Condensations with Ethyl Acetoacetate and their Reversal	i, 623
SIMON (L. J.). New Product of the Destructive Distillation of Tartaric Acid	i, 624
SIMON (L. J.). <i>iso</i> Pyrotritaric Acid; a New Pyrogenic Product from Tartaric Acid	i, 624
TIERMANN (FERDINAND) [and MAX KERSCHBAUM]. Pinolic Acid	i, 625
SCHMALZHOFFER (F. X.). Condensation of Acetaldehyde with Propaldehyde	i, 626
CHRISTENSEN (JOSEPH C.). Boiling Points of Mixtures of Chloral and Water	i, 626
BAEYER (ADOLF VON) and VICTOR VILLIGER. Nomenclature of the Peroxides: Aldehydic Peroxides	i, 626
WOHL (ALFRED) and W. EMMERICH. Semi-aldehyde of Malonic Acid	i, 627
SALKOWSKI (ERNST L.). Fermentation of Pentoses	i, 628
ADRIANI (J. H.). Nature of Inactive Sorbose	i, 628
WEISBERG (JULIUS). Solubility of Lime in Saccharine Solutions	i, 628
SCHUKOFF (IWAN). Trehalose	i, 628
VIGNON (LÉO). Oxycelluloses of Cotton, Flax, Hemp, and Rhea	i, 628
VIGNON (LÉO) and F. GERIN. Acetyl Derivatives of Cellulose and Oxy-cellulose	i, 629
VIGNON (LÉO). Reduction of Nitrocelluloses	i, 629
KIJNER (NIC. M.). Action of Silver Oxide on Bromoamines with Tertiary Amino-Groups	i, 629
BEWAD (IWAN I.). Action of Zinc Alkyls on Nitrous Esters and Nitro-paraffins	i, 629

	PAGE
BALBIANO (LUIGI) and D. TRASCIATTI. New Derivative of Glycine . . .	i, 632
WHEELER (HENRY L.) and TREAT B. JOHNSON. Behaviour of Acylthion-carbamic Esters with Alkyl Iodides and Amines; Benzoyliminothio-carbamic Esters, Acyclic Benzoylpseudocarbamides and Benzoylcarb-amides . . .	i, 632
TUNNICLIFFE (FRANÇOIS W.) and OTTO ROSENHEIM. Salts of Uric Acid . .	i, 636
ARMSTRONG (E. FRANKLAND). 3-Ethyluric Acid . . .	i, 636
GEUNS (J. W. VAN). Explosiveness of a Mixture of Potassium Cyanide and Nitrite . . .	i, 636
NIEMCZYCKI (ST.). Three Normal Butyltoluenes [Methyl- <i>n</i> -butylbenzenes]	i, 636
SWARTS (FRÉDÉRIC). Fluorine Derivatives of Toluene . . .	i, 637
HOLLEMAN (ARNOLD F.) and B. R. DE BRUYN. Simultaneous Formation of Isomeric Substitution Products of Benzene . . .	i, 638
REVERDIN (FRÉDÉRIC) and PIERRE CRÉPIEUX. Nitration of <i>m</i> -Chloro-toluene . . .	i, 638
KUNCKELL (FRANZ) and F. GOTSCH. $\alpha\beta$ -Dichlorostyrenes and some Acetylenes . . .	i, 638
BAUR-THURGAU (ALBERT). Derivatives of Butylxylene [1:3-Dimethyl-5-butylbenzene] . . .	i, 639
BOUGAULT (J.). Action of Iodine and Mercuric Oxide on Styrene and Saffrole . . .	i, 641
HAUSER (O.) and LUDWIG VANINO. Double Salts of Bismuth Chloride with some Organic Bases . . .	i, 641
TINGLE (ALFRED). New Synthesis of Secondary Amines . . .	i, 641
BRAUN (JULIUS VON). Action of Cyanogen Bromide on Tertiary Amines. II. . .	i, 641
BRAUN (JULIUS VON). Preparation of Phenylated Guanidines from Diphenylcyanamide . . .	i, 642
MEYER (RICHARD E.) and G. VON LUTZAU. Formation and Stability of Acid Amides . . .	i, 643
CHATTAWAY (FREDERICK D.) and KENNEDY J. P. ORTON. Anilines and Anilides . . .	i, 643
MOUNEYRAT (ANTOINE). Conversion of α -Amino-acids into Phenyl-hydantoins . . .	i, 644
BRAUN (JULIUS VON). Convenient Method for the Preparation of Aromatic Thiocarbamides . . .	i, 644
VORLÄNDER (DANIEL) and A. T. DE MOUILPIED. Action of Sodium Ethoxide on Ethyl Anilinoacetate . . .	i, 644
REVERDIN (FRÉDÉRIC) and PIERRE CRÉPIEUX. Chlorination of Aceto- <i>m</i> -toluidide . . .	i, 644
BORSOHE (WALTHER). Constitution of Metapurpuric Acid . . .	i, 645
FRAPS (G. S.). Purification of Phloroglucinol . . .	i, 645
WALBRAUM (HEINRICH). Occurrence of Phenylethyl Alcohol in Rose Blossoms . . .	i, 645
SEYEWETZ (ALPHONSE). Compounds of Magenta with Acid Colouring Matters having a Basic Chromophore . . .	i, 645
FISCHER (EMIL). Resolution of Racemic Amino-acids into Optically Active Components. III. . .	i, 646
FISCHER (EMIL) and ANTOINE MOUNEYRAT. Resolution of Racemic Amino-acids into Optically Active Components. IV. . .	i, 647
PIEPES-PORATYNSKI (JAN). Polymerisation of <i>p</i> -Toluenitrile . . .	i, 648
LIEBERMANN (CARL) and C. N. RIEBER. Boiling and Subliming Points of some Allo-acids . . .	i, 648
SIMONIS (HUGO) and G. WENZEL. Bromocoumarins and their Derivatives. III. . .	i, 648
ERLENMEYER, (EMIL, jun.). Action of Phenylhydrazine and of Hydroxyl-amine on Ethyl Phenylcyanopyruvate . . .	i, 649
VORLÄNDER (DANIEL) and C. KOETTNITZ. Formation of Indigotin from Ethyl Anthranilate . . .	i, 649
BEIJERINCK (MARTINUS W.). Formation of Indigotin from Woad . . .	i, 649

STOERMER (RICHARD) [and in part HANS BAUER, BOES, VON FINCKH, GRÄFENHAN, K. P. GRÄLERT, GROSS, M. HELBIG, HERMES, KISSEL, O. RICHTER, PAUL SCHROCKENBERGER, and A. TEUDELLOFF. Synthesis and Degradation in the Coumarone Series	i, 650
KRAEMER (GUSTAV) and ADOLF SPILKER. Indene, and Coumarone Resins	i, 656
WEGSCHEIDER (RUDOLF). Esterification of Unsymmetrical Polybasic Acids. I. Esterification of Nitroterephthalic Acid	i, 657
WEGSCHEIDER (RUDOLF) and KARL BITTNER. Esterification of Unsymmetrical Polybasic Acids. II. Esterification of Bromo- and Hydroxy-terephthalic Acids	i, 658
MOSES (NATHAN). <i>p</i> -Cyanobenzyl Chloride	i, 658
STOBBE (HANS). Transformation of Coloured Unsaturated Dicarboxylic Acids into Colourless Stereoisomerides	i, 659
MEYER (RICHARD E.). Coloured Sulphur Compounds of the Diphenyl- and Triphenyl-methane Series	i, 660
MEYER (RICHARD E.) and J. SZANECKI. Coloured Sulphur Compounds of the Diphenyl- and Triphenyl-methane Series. II.	i, 660
LANDAU (JOSEF). Mixed Esters of Cochinilic Acid	i, 661
LANDAU (JOSEF). Diketohydrindene Derivatives of Cochinilic Acid	i, 661
PATERNÒ (EMANUELE). Constitution of Usmic Acid	i, 662
BILTZ (HEINRICH). Oxidation with Atmospheric Oxygen	i, 662
KUNCKELL (FRANZ) [and in part G. HECKER and G. TREUTLER]. Halogenised Aromatic Amino-ketones	i, 663
KUNCKELL (FRANZ). New Method of Preparing Aromatic Amino-ketones	i, 664
WEDEKIND (EDGAR). New Synthesis of Ketones	i, 665
SCHLOSSBERG (S.). 3-Bromo-1-indone and its Derivatives	i, 665
LANSER (THEODOR) and FRITZ WIEDERMANN. Halogen-substituted Indone Derivatives of β -Diketones	i, 666
LIEBERMANN (CARL) and L. FLATOW. Action of Iodine on Ethyl Sodio-diketohydrindenecarboxylate	i, 667
LANDAU (JOSEF). Trisdihydroxybenzoylenebenzene	i, 667
KOSTANECKI (STANISLAUS VON) and A. SEIFART. 2:2'-Dihydroxyflavone	i, 668
CRIVELLI (C.) and STANISLAUS VON KOSTANECKI. β -Methyl-2-hydroxy-chromone	i, 668
GROSSMANN (S.) and STANISLAUS VON KOSTANECKI. 4'-Hydroxyflavone	i, 669
MICHEL (FR.). 2:3-Dichloro- α -naphthaquinolyl Derivatives of β -Diketones	i, 669
HIRSCH (H.). Halogen-substituted β -Naphthaquinolyl Derivatives of β -Diketones	i, 670
DUDEN (PAUL) and W. TREFF [in part with D. HEYNSIUS]. Synthetical Bases of the Series of Terpenes and Camphors: Pyrrole Derivatives of the Camphor Group	i, 671
DUDEN (PAUL) and ALFRED E. MACINTYRE [and in part J. ROBERTSON]. Synthetical Bases of the Series of Terpenes and Camphors: Camphenamine and β - <i>iso</i> Camphor	i, 674
ANGELICO (FRANCESCO). Camphordioximes	i, 675
CZERNY (HANS). Fenchone	i, 675
SEMMLER (FRIEDRICH W.). Carvotanacetone, Tanacetone, and Terpenone, $C_{10}H_{18}O$ (from Tetrahydrocarvone)	i, 676
TYLER (CHAS. T.) and ALFRED WERTHEIMER. Oil of Turpentine	i, 676
DOWZARD (EDWIN). Viscosity of Essential Oils	i, 676
KLASON (PETER). Ethereal Oil of Fir Wood (<i>Pinus abies</i> , L.)	i, 676
ROMBURGH (PIETER VAN). Crystallised Constituent of the Essential Oil of <i>Kaempferia galanga</i> , L.	i, 677
WALBAUM (HEINRICH) and KARL STEPHAN. German Rose Oil	i, 677
SODEN (HUGO VON). Constituents of East Indian Sandalwood Oil	i, 677
MÜLLER (FRIEDRICH). East Indian Sandalwood Oil	i, 677
TSCHIRCH (ALEXANDER) and ED. BRÜNING. The Balsam of <i>Abies canadensis</i> (Canada Balsam)	i, 676
TSCHIRCH (ALEXANDER) and G. WEIGEL. The Balsam of <i>Abies pectinata</i> (Strasburg Turpentine)	i, 679

	PAGE
TSCHIRSCH (ALEXANDER) and G. WEIGEL. The Balsam of <i>Larix decidua</i> (Larch Turpentine)	i, 680
FRANCHIMONT (ANTOINE P. N.). Plumieride and its Identity with Agoniadin	i, 680
VONGERICHTEN (EDUARD). Luteolin Methyl Ether as a Product of the Hydrolysis of a Glucoside from Parsley	i, 681
TSCHIRSCH (ALEXANDER) and R. POLACCO. The Fruits of <i>Rhamnus cathartica</i>	i, 681
TSCHIRSCH (ALEXANDER) and E. HIEPE. Senna	i, 681
HILGER (ALBERT). Colouring Matter of Saffron	i, 682
CROSS (CHARLES F.), EDWARD J. BEVAN, and JOHN F. BRIGGS. Interaction of Furfuraldehyde and Caro's Reagent	i, 682
SHEEDEN (FRANK). Composition of Berberine Phosphate	i, 683
GORDIN (HARRY M.). The Alkaloids of <i>Ceanothus americanus</i>	i, 683
DECKER (HERMAN). Some Ammonium Compounds. VI. Formula of Cotarnine	i, 683
GREIMER (KARL). Poisonous Boragineæ Alkaloids	i, 683
RAUWERDA (A.). Cytisine and some of its Alkyl Derivatives	i, 684
POMMERENNE (HERBERT). Damascenine, a Constituent of the Seeds of <i>Nigella Damascena</i> , L.	i, 684
PICTET (AMÉ) and B. ATHANASESCU. Laudanosine	i, 685
PICTET (AMÉ) and A. ROTSOHY. Inactive Nicotine	i, 685
PICTET (AMÉ). Reduction of Nicotyrine to Inactive Nicotine	i, 685
PINNER (ADOLF) and ERICH KOHLHAMMER. Pilocarpine	i, 685
JOWETT (HOOPER A. D.). Constitution of Pilocarpine	i, 686
MURRILL (PAUL) and J. O. SCHLOTTERBECK. The Alkaloids of <i>Bocconia (Macleaya) cordata</i>	i, 686
HILDEBRANDT (HERMANN). Syntheses in the Animal Organism. I. Piperidine Derivatives	i, 686
SCHMIDT (ERNST) and H. HARTONG VAN ARK. Action of Bromoacetophenone on Piperidine	i, 686
BRAUN (JULIUS VON). Action of Cyanogen Bromide on Tertiary Amines. III.	i, 687
SAULMANN (FRITZ). Thiazolines and Oxazolines	i, 687
SCHMIDT (ERNST) and H. HARTONG VAN ARK. Action of Bromoacetophenone on Pyridine	i, 687
PFEIFFER (PAUL). Additive Compounds formed by Nitriles with Tripyridinechromium Trichloride: Dithiocyanodiethylenediaminechromium Salts	i, 688
DECKER (HERMAN). Luminosity of 1-Ethyl-2-quinolone	i, 688
DECKER (HERMAN). Some Ammonium Compounds. VII. The Nitration of Alkyl-Quinoline Salts	i, 689
GABRIEL (SIEGMUND) and JAMES COLMAN. Transformations of Phthaliminoketones	i, 689
ULLMANN (FRITZ) and E. NAEF. Aminonaphthacridinium Compounds	i, 689
BÜLOW (CARL). Difference of Basicity of the two Amino-groups of Substituted Diamines. I. <i>m</i> -Tolylenediamine	i, 690
COHN (PAUL) and ARMIN FISCHER. Preparation of Diphenylmethane Derivatives from <i>p</i> - and <i>o</i> -Aminobenzylaniline and their Homologues	i, 690
WOLFF (LUDWIG) [and in part EDUARD FERTIG and A. LÜTTINGHAUS]. 4-Hydroxypyrazole and its Derivatives	i, 691
MICHAELIS (AUGUST) and HEINRICH BEHN. 5-Chloro- and 5-Bromo-1-phenyl-3-methylpyrazoles	i, 692
MICHAELIS (AUGUST) and G. SCHWABE. 1- <i>p</i> -Bromophenyl-3-methyl-5-chloropyrazole	i, 695
MICHAELIS (AUGUST) and TH. SUDENDORF. 5-Chloro-1- <i>p</i> -tolyl-3-methylpyrazole and Antipyrine-Bz-carboxylic Acid	i, 696
GALLINEK (ALFRED). Aminomethylnaphthimidazolesulphonic Acid	i, 697
LÖB (WALTHER). Electrolytic Preparation of Benzidine	i, 697
FISCHER (EMIL) and WOLF VON LOEBEN. 3-Phenylpurine	i, 697
WOHL (ALFRED). Triazan Derivative from Nitrosoformylphenylhydrazine	i, 698
WOHL (ALFRED) and CARL OESTERLIN. Benzylhydrazine	i, 698

	PAGE
CURTIUS (THEODOR). Action of Nitrous Acid on Benzylhydrazine . . .	i, 698
BUSCH (MAX) and BRUNO WEISS. <i>as</i> -Dibenzylhydrazines . . .	i, 699
CURTIUS (THEODOR). Reduction of Benzylidenehydrazine to Benzyl- hydrazine . . .	i, 700
CURTIUS (THEODOR) and A. LUBLIN. Nitrobenzylidenehydrazines . . .	i, 700
CURTIUS (THEODOR) [and in part H. MELSBACH]. Preparation of Aromatic Aldehydes from the Corresponding Acids by means of Hydrazine . . .	i, 701
CAENEUVE (PAUL) and PAUL SISLEY. Tinctorial Properties of Diphenyl- carbazone . . .	i, 701
REVERDIN (FRÉDÉRIC) and PIERRE CRÉPIEUX. Influence of the Orienta- tion of Chromophores on the Colour and other Properties of Dyes . . .	i, 701
MEIGEN (WILHELM) and W. NORMANN. Action of Hypochlorous Acid on Primary Aromatic Amines . . .	i, 702
HANTZSCH (ARTHUR). Nomenclature of the Diazo-compounds . . .	i, 702
HANTZSCH (ARTHUR) [and in part GUSTAV OSSWALD, W. SEMPLE, and J. SPEAR]. Decomposition of Diazonium Salts . . .	i, 703
HANTZSCH (ARTHUR) and J. W. BLAGDEN. Interaction of Diazonium Salts with Cuprous Compounds . . .	i, 704
BAMBERGER (EUGEN) and JENS MÜLLER. New Method of Preparing <i>iso</i> Diazotates . . .	i, 705
GERILOWSKI (DIMITER W.). <i>syn</i> -Diazotates from <i>p</i> -Bromodiazobenzene- <i>o</i> -sulphonic Acid . . .	i, 706
WOHL (ALFRED) and HANS SCHIFF. Diazohydrazides and Bisdiazotetr- azones (Octazones) . . .	i, 706
MAAS (OTTO). First Cleavage Product of Proteid by the Action of Alkali . . .	i, 708
HOUGARDY. Albumin in Ox Serum . . .	i, 709
PANORMOFF (ALEXEI A.). Action of Dilute Acids, Alcohol, and Heat on Columbinin . . .	i, 709
NENOKI (MARCELLUS) and J. ZALESKI. Colouring Matter of Blood . . .	i, 709
SCHWANTKE (ARTHUR). Crystals from Pigeons' Blood . . .	i, 711
ZEYNEK (RICHARD VON). Hæmatin and Hæmochromogen obtained by the use of Pepsin-hydrochloric Acid . . .	i, 711
JACOBY (MARTIN). Aldehydase from the Liver and Suprarenal Capsule . . .	i, 711
WINDISCH (WILHELM) and B. SCHELLHORN. Proteolytic Enzyme of Germinated Barley . . .	i, 712
BABCOCK (S. MOULTON) and H. L. RUSSELL. Galactase, the Proteolytic Ferment peculiar to Milk, its Properties, and Action on the Proteids of Milk . . .	i, 712
FREUDENREICH (ED. VON). The Organised Ferment present in Milk, the <i>so</i> -called Galactase . . .	i, 712

PART II.

General and Physical Chemistry.

TROWBRIDGE (JOHN). Spectra of Hydrogen and of Aqueous Vapour . . .	ii, 701
LEWIS (PEROIVAL). Influence of Slight Impurity on the Spectrum of a Gas. II.	ii, 701
BECKMANN (ERNST). Lamps for Spectra. I.	ii, 701
LEWIS (PEROIVAL). Fluorescence and Afterglow accompanying an Electric Discharge in Nitrogen	ii, 702
GOLDSTEIN (EUGEN). Phosphorescence of Inorganic Substances	ii, 702
AFANASEFF. Action on Photographic Plates of Minerals containing Uranium and Thorium	ii, 702

	PAGE
COHEN (ERNST). Meta-stable Character of the Weston Cadmium Element and its Uselessness as a Standard Cell	ii, 702
JAEGER (WILHELM) and ST. LINDECK. The Weston Cell	ii, 703
COHEN (ERNST). Thermodynamics of Normal Cells. II.	ii, 703
MIE (GUSTAV). An Application of Poynting's Theorem	ii, 703
MILLER (W. LASH.) and FRANK B. KENRICK. Quantitative Lecture Experiments on Electrochemistry	ii, 703
GOCKEL (ALBERT). Relations between Polarisation and Current Density in Solid and Fused Salts	ii, 704
CAMPETTI (A.). Difference of Potential between a Solid Salt and its Solution	ii, 704
BOSE (EMIL). Electromotive Efficiency of the Elementary Gases. I.	ii, 704
LUTHER (ROBERT) [and in part D. R. WILSON]. Electromotive Behaviour of Substances with several Stages of Oxidation. I.	ii, 705
HITTORF (WILHELM). Passivity of the Metals	ii, 705
BROCHET (ANDRÉ). Ostel's Gasometric Method	ii, 706
BROCHET (ANDRÉ). Accessory Reactions in Electrolysis	ii, 706
LÖB (WALTHER). Researches on Electrolytic Reduction	ii, 706
KRÜGER (FRIEDRICH). Electrolytic Solution Pressure. Reply to Lehfeldt	ii, 706
JAHN (HANS). Degree of Dissociation and Dissociation Equilibrium in the case of Highly Dissociated Electrolytes	ii, 707
LANG (ROBERT). Magnetic Force of the Atoms	ii, 707
HEMPINNE (ALEXANDRE DE). Has Magnetism an Influence on Chemical Reactions?	ii, 707
HEINRICH (G.). Magnetic Behaviour of Alcohols	ii, 707
FEITAG (HUGO). Magnetic Susceptibility of Aromatic Organic Substances	ii, 708
LAAR (J. J. VAN). Relation between Heat of Solution and Solubility of Electrolytes	ii, 708
DUEHM (PIERRE). Continuous Change and Thermodynamics. VI.	ii, 708
SMITS (A.). Diminution of Vapour Pressure and Elevation of Boiling Point of Dilute Solutions	ii, 708
WÖRINGER (JENEDIKT). Vapour Pressure of a Series of Benzene Compounds	ii, 709
BATELLI (ANGELO) and A. STEFANINI. Cryoscopic and Ebullioscopic Researches	ii, 709
GUYE (PHILLIPE A.) and L. FRIDERICH. Calculations in connection with the Equations of Condition for Liquids. I. Determination of the Constants α and b of van der Waals' Equation	ii, 709
PARR (SAMUEL W.). A New Coal Calorimeter	ii, 710
TAYLER (J. B.). Heat of Formation of Alloys	ii, 710
GLADSTONE (JOHN H.). Want of Uniformity in the Action of Copper-Zinc Alloys on Nitric Acid	ii, 710
BUCHANAN (JOHN Y.). Steam and Brines	ii, 710
YOUNG (SYDNEY). The Law of Cailliet and Mathias and the Critical Density	ii, 711
WILSON (HAROLD A.). Velocity of Solidification and Viscosity of Supercooled Liquids	ii, 712
TÜRIN (VL. VON). Extent to which the Interaction of Ionic Charges diminishes the Osmotic Pressure	ii, 712
KOHLRAUSCH (FRIEDRICH). A Model to Show Ionic Mobility	ii, 712
OSTWALD (WILHELM). Supposed Isomerism of Red and Yellow Mercuric Oxide, and the Surface Tension of Solid Bodies	ii, 712
ZAWIDZKI (JAN VON). Composition of the Surface Layers of Aqueous Solutions	ii, 713
TANATAR (SIMÉON) and BORIS KLIMENKO. Formation of Salts in Alcoholic Solutions	ii, 713
STOECKL (K.) and LUDWIG VANINO. Colloidal Metallic Solutions	ii, 713
SPRING (WALTHER). Flocculation of Turbid Media	ii, 713
BRUNI (GIUSEPPE) and F. GORNI. Solid Solutions and Isomorphous Mixtures of Saturated and Non-saturated Open-chain Compounds. III.	ii, 714

	PAGE
TAMMANN (GUSTAV). Limits of the Solid State. V.	ii, 714
REINDERS (W.). Equilibrium between Lead and Zinc, and Mixtures of their Fused Chlorides	ii, 715
BODLÄNDER (GUIDO). Solubility of Carbonates of Alkaline Earths in Water containing Carbon Dioxide	ii, 715
FINDLAY (ALEXANDER). Theory of the Fractional Precipitation of Neutral Salts and its Application in Analytical Chemistry	ii, 716
COHEN (ERNST). Studies on Inversion. I.	ii, 716
RAMBERG (LUDWIG). Action of Bromine on Phenylsulphonacetic acid and α -Phenylsulphonpropionic Acid in Aqueous Solution: a Contribution to Chemical Kinetics	ii, 717
LOBBY DE BRUYN (CORNELIS A.). Physical Condition of Substances Insoluble in water formed in Gelatin	ii, 717
LINCK (GOTTLÖB). G. Linck's Crystallographic Views	ii, 717
STREATFIELD (FREDERICK W.) and FRANK SOUTHERDEN. Laboratory Apparatus	ii, 718
ITTNER (MARTIN H.). Modification of the Water Vacuum Pump	ii, 718
KOENIG (GEORG AUGUST). Economical Constant Gas Generator	ii, 718

Inorganic Chemistry.

FRENCH (WILLIAM). Influence of Finely Divided Platinum on the Combination of Hydrogen and Oxygen	ii, 718
BAEYER (ADOLF VON) and VICTOR VILLIGER. Action of Permanganate on Hydrogen Peroxide and on Caro's Acid	ii, 719
HABER (FRITZ). Autoxidation	ii, 720
HABER (FRITZ) and FR. BRAN. Autoxidation. II.	ii, 720
GROUSINOFF (A. A.). Change in Composition of Liquid Air on Evaporation	ii, 720
GAUTIER (ARMAND). Nature of the Accessory Combustible Gases in the Air of Paris	ii, 720
WARBURG (EMIL). Formation of Ozone by a Point-discharge in Oxygen	ii, 721
LADENBURG (ALBERT). Ozone. IV.	ii, 721
BLEIER (OTTO) and LEOPOLD KOHN. Molecular Weight and Vapour Density of Sulphur	ii, 721
CHATTAWAY (F. D.) and K. J. P. ORTON. Action of Alkaline Hydroxides of Water and of Hydrogen Peroxide on Nitrogen Iodide	ii, 722
CHATTAWAY (F. D.) and H. P. STEVENS. Action of Acids on Nitrogen Iodide	ii, 722
CHATTAWAY (F. D.) and K. J. P. ORTON. Formation and Constitution of Nitrogen Iodide	ii, 722
SAPOSCHNIKOFF (A. V.). Condition of Nitrous Acid in Aqueous Solutions	ii, 722
ANGELI (ANGELO) and FRANCESCO ANGELIOO. Reaction of Nitroso-Derivatives	ii, 722
VANINO (LUDWIG) and O. HAUSER. Reduction of Nitrates by Lactic Acid	ii, 722
NOELTING (EMILIO) and W. FEUERSTEIN. Preparation of Phosphorus Free from Arsenic	ii, 722
WARTH (H.). Composition of Soot from Mineral Coal	ii, 723
LADENBURG (ALBERT) and C. KRÜGEL. Krypton	ii, 723
CORDIER (V. VON). Action of Chlorine on Metallic Silver in the Light and in the Dark	ii, 723
HELLWIG (KARL). Some Complex Silver Salts	ii, 723
MULDER (EDUARD). Silver Peroxysulphate and Peroxyacetate	ii, 724
COHEN (ERNST) and H. RAKEN. Solubility of Calcium Carbonate in Seawater	ii, 725
KASSNER (GEORG). Orthoplumbates of the Alkaline Earths. IV. Lead "Peroxide"	ii, 725

	PAGE
CUSHMAN (ALLERTON S.). Some Isomeric Halogen Compounds of Thallium and the Constitution of Double Salts	ii, 725
MOISSAN (HENRI). Preparation and Properties of Neodymium and Praseodymium Carbides	ii, 726
ALLEN (EUGENE T.). Hydroxides of Aluminium	ii, 726
ALLEN (EUGENE T.) and H. F. ROGERS. Action of Caustic Hydroxides on Aluminium	ii, 727
HERZ (W.). Aluminates	ii, 728
DUFAU (EMILE). Crystallised Monocalcium Aluminate	ii, 728
HEYN (E.). Iron and Hydrogen	ii, 728
ROOZEBOOM (H. W. BAKHUIS). Iron and Steel from the Standpoint of the Phase Rule	ii, 728
LEBEAU (PAUL). Iron Silicide, Fe_3Si , and its presence in Ferro-Silicons	ii, 729
FONZES-DIACON (HENRI). Nickel Selenides	ii, 730
OSTWALD (WILHELM). Periodic Phenomena in the Dissolution of Chromium in Acids	ii, 730
LEY (HEINRICH). Constitution of Uranyl Salts	ii, 731
KOWALEWSKY (WL. VON). Behaviour of some Halogen Compounds of the Carbon Group analogous to Stannic Chloride	ii, 731
REINDERS (W.). Alloys of Antimony and Tin	ii, 731
MIOLATI (ARTURO) and I. BELLUCCI. Pentachloroplatinic Acid	ii, 732
MIOLATI (ARTURO) and I. BELLUCCI. Platinum Tetrabromide	ii, 732
RÖSSLER (HEINRICH). Behaviour of Rhodium in Alloys with the Noble Metals	ii, 732

Mineralogical Chemistry.

GOODCHILD (GEORGE JOHN). Genesis of some Scottish Minerals	ii, 733
KLOOS (JOHAN H.). Cinnabar-bearing Trachyte-tuff from South Tuscany	ii, 733
KATZER (FRIEDRICH). Manganese Ore from the Amazon District	ii, 733
BECK (RICHARD). Tin Ores from Banca and Billiton	ii, 734
VOGT (J. H. L.). Marbles	ii, 734
KOERT (W.). Phosphorite [from North Germany]	ii, 734
SJÖGREN (HJALMAR). Analyses of Minerals from the Langesund Fjord	ii, 734
WOLFF (JOHN E.). Hardystonite and Zinc-schefferite from Franklin Furnace, New Jersey	ii, 735
TERMIER (PIERRE). Epidote and Zoisite	ii, 735
RIMATORI (CARLO). Chabazites from Sardinia, and from the Granulites of Striegau, Silesia	ii, 735
BLANCKENHORN (MAX). A New Mineral from near Cassel	ii, 736
LOVISATO (DOMENICO). Altered Fayalite from the Granulites of Villacidro	ii, 736
COHEN (EMIL W.). Meteoric Irons from Griqualand East, South Africa	ii, 736
COHEN (EMIL W.). Meteoric Iron from Bethany, Great Namaqualand	ii, 736
MERRILL (GEORGE P.) and HENRY N. STOKES. New Meteorites from Allegan, Michigan, and Mart, Texas	ii, 737

Physiological Chemistry.

MOORE (BENJAMIN) and C. O. PURINTON. The Influence of Minimal Doses of Suprarenal Extracts on Blood-pressure	ii, 737
WEIGERT (RICHARD). Changes in the Substances in the Blood which are Soluble in Ether	ii, 738
HÖBER (RUDOLF). Hydroxyl-ions of the Blood	ii, 738
MEDVEDEFF (AN. K.). Oxidation in Animal Tissues	ii, 738
REBEN (FRANZ). Composition of the Fat of Human Chyle	ii, 739

	PAGE
WEDENSKI (NICOLAI E.). The Properties of Nerve under the Influence of Certain Poisons	ii, 739
LINGLE (D. J.). Action of Certain Ions on Ventricular Muscle	ii, 739
SCHÖNDORFF (BERNHARD) [with HEINRICH OFFERGELD]. Origin of Glycogen from Proteid	ii, 740
NERKING (JOSEPH). Can the Whole of the Glycogen Present in an Organ be Removed by Sufficiently Long Extraction with Boiling Water?	ii, 740
SALKOWSKI (ERNST). Origin and Excretion of Oxalic Acid	ii, 740
GOTO (MOTONOSUKE). Solubility of Uric Acid in Nucleic and Thymic Acids	ii, 740
BERTHELOT (MARCELLIN P. E.). Absorption of Free Oxygen by Normal Urine	ii, 740
BERTHELOT (MARCELLIN P. E.). Acidity of Urine	ii, 741
NAEGELI (OTTO). Estimation of the Acidity of Urine	ii, 741
LAWROFF (D.). Excretion of Antipyrine by the Animal Body	ii, 741
BORDET (JULES). Hæmolytic Serums	ii, 741
NOLF (PIERRE). Anti-hæmatic Serums	ii, 741
METCHNIKOFF (ÉLIE). Cytotoxins	ii, 741
CANTACUZÈNE (J.). Hæmolytic Serum and Red Corpuscles	ii, 741
BESREDEKA. Leucotoxin	ii, 741
METCHNIKOFF (ÉLIE) and BESREDEKA. Action of Hæmatotoxin on Man	ii, 741
CHRISTMAS (J. DE). The Gonococcus and its Toxin	ii, 742
PADERI (CESARE). Relationship between Chemical Constitution and Physiological Action. I. Physiological Action of Alkines of Piperidine	ii, 742

Chemistry of Vegetable Physiology and Agriculture.

BARTHEL (CHR.). Researches on the Formation of Acetic Acid by Bacteria producing Lactic Acid	ii, 742
BOEKHOUT (F. W. J.). Micro-organisms forming Dextran	ii, 742
EMMERLING (OSKAR). Schizomycetic Fermentation	ii, 742
KOZAI (YOSHINAO). Chemical and Biological Researches on the Preparation of "Sake"	ii, 743
KLÖCKER (ALBERT). Is the Formation of Enzymes a Trustworthy Characteristic of Yeasts?	ii, 743
WEHMER (CARL). "Chinese Yeast" and the so-called Amylomyces (<i>Mucor Rouzii</i>)	ii, 743
MIGULA (W.). Nitrification in the Soil of Forests	ii, 744
BUTKEWITSCH (WL.). Occurrence and Action of Proteolytic Ferments in Germinated Seeds	ii, 744
HARLAY (V.). Proteolytic Ferments of Germinating Seeds	ii, 744
LÖVINSON (OSKAR). Germination and Growth of Peas in Solutions of Salts of Fatty Acids	ii, 744, 745
SCHULZE (ERNST). Proteid Metabolism in Plants	ii, 745
HOTTER (EDUARD). Material for Plant Nutrition in Apples and Pears	ii, 745
BOKHORNY (THOMAS). Myrosin	ii, 746
BARTH (GEORG). Bitter Principles of Hops	ii, 746
SCHLOTTERBECK (JULIUS O.). <i>Adlumia cirrhosa</i> —A New Protopine-bearing Plant	ii, 746
HARTWICH (C.) and E. DÜNNENBERGER. An Alcornoco Bark known commercially as Jaborandi, and Alcornoco Barks in general	ii, 747
FRANKFORTER (GEORGE B.). <i>Astragalus caryocarpus</i>	ii, 747
LETTIS (EDMUND A.) and JOHN HAWTHORN. The Sea-weed <i>Ulva latissima</i> and its Relation to the Pollution of Sea-water by Sewage	ii, 747
KAHLBERG (LOUIS) and ROLLAN M. AUSTIN. Toxic Action of Acid Sodium Salts on <i>Lupinus albus</i>	ii, 747
FRAPS (G. S.). Digestibility of some Non-nitrogenous Constituents of certain Feeding Stuffs	ii, 748

	PAGE
KNIERIEM (WOLDEMAR VON). Rye as Food	ii, 748
KNIERIEM (WOLDEMAR VON). Vetch Corn as Food	ii, 749
RAMM (EBERHARD). Feeding Cows with Cane Sugar	ii, 749
RAMM (EBERHARD). Feeding Cows with Maize Gluten	ii, 749
RAMM (EBERHARD). Feeding Cows with Malt-germ Molasses	ii, 749
RAMM (EBERHARD) and C. MOMSEN. Non-saccharine Matter contained in Molasses	ii, 750
KOSUTÁNY (TÁMAS), RICHARD WINDISCH, E. VON HÉRICIUS-TÓTH, LADISLAUS VON SZÉLL and ADOLF FALTIN. Beans	ii, 750
TASSELLI (EMILIO). Cork Oak	ii, 750
SAMOGGIA (M). Hemp	ii, 750
GUPPIN (HENRI). Cultivation of Parsnip	ii, 751
PFEIFFER (THEODOR). Effect of Different Potassium Salts on the Composition and Yield of Potatoes	ii, 751
BITTÓ (BÉLA VON). Soil Investigations in the Tokay Wine District	ii, 751
DOERSTLING (P.). Practical Conclusions from [the Results of] Soil Analyses	ii, 752
KOURIMSKY (LEOPOLD). Composition of some Manure-soils	ii, 752
HANAMANN (JOSEF). Manurial Experiments	ii, 752
OTTO (RICHARD). Manurial Experiments with Vegetables	ii, 753
BERTHAULT. Distribution of Manures	ii, 753
PFEIFFER (THEODOR), F. MOSZEIK, and OTTO LEMMERMANN. Methods of Experiments on the Preservation of Farm-yard Manure	ii, 753
CASALI (ADOLFO). Street-dust as Manure	ii, 754

Analytical Chemistry.

SPIEGEL (LEOPOLD). <i>p</i> -Nitrophenol as an Indicator	ii, 754
FRAPS (G. S.). Wide Occurrence of Indicators in Nature	ii, 754
FRESENIUS (WILHELM). Abegg and Herz's Method for the Separation and Recognition of Acids	ii, 754
BLATTNER (N.) and J. BRASSEUR. Estimation of Potassium Perchlorate in Alkali Nitrates (Nitre and Chili Saltpetre)	ii, 755
BLATTNER (N.) and J. BRASSEUR. Process for the Estimation of Chlorides, Chlorates, and Perchlorates in the Presence of each other	ii, 755
BARRIE (THOMAS S.). Estimation of Potassium Iodide	ii, 755
LETTIS (EDMUND A.) and ROBERT F. BLAKE. Simple and Accurate Method for Estimating the Dissolved Oxygen in Fresh-water, Sea-water, Sewage Effluents, &c.	ii, 755
ARCHBUTT (LEONARD). Estimation of Oxygen in Copper by Ignition in Hydrogen	ii, 756
MUKERJI (P.). Detection of Free Phosphorus	ii, 756
CAMP (J. M.). Estimation of Phosphorus in Coke and Coal	ii, 756
CAMP (J. M.). Estimation of Phosphorus in Ores, Pig-iron, and Steel containing Arsenic	ii, 757
IBBOTSON (FRED) and HARRY BREARLEY. Estimation of Phosphorus in Steel, &c.	ii, 757
SHERMAN (H. C.), and HENRY ST. JOHN HYDE. Estimation of Phosphoric Acid as Phosphomolybdic Oxide	ii, 757
HAYWOOD (JOHN K.). Adulteration and Analysis of Arsenical Insecticides	ii, 758
HILGARD (EUGEN W.). [Estimation of] Free Arsenious Oxide in Paris Green	ii, 758
WADE (E. M.), and M. L. WADE. Qualitative Test for Boric Acid	ii, 758
WAVELET. Estimation of Potassium by Phosphomolybdic Acid	ii, 758
NEUBAUER (HUGO). Shortened Method for Estimating Potassium in its Salts	ii, 759
SÜSS (P.). Detection of Sodium Carbonate in Milk	ii, 759
DIVINE (R. E.). Estimation of Free Alkali in Soaps	ii, 759

	PAGE
ANDREWS (LAUNCELOT W.). New Volumetric Method for the Estimation of Silver	ii, 760
EULER (WILHELM). Gravimetric Estimation of Zinc as Sulphate	ii, 760
MILLER (EDMUND H.) and HENRY FISHER. Lead and Cadmium Ferrocyanides	ii, 761
MENNICKE (H.). Analysis of Lead and Tin Ores, also of the most important Lead and Tin Preparations, and their Commercial Products	ii, 761
PARR (SAMUEL W.). New Volumetric Method for the Estimation of Copper	ii, 762
ZECCHINI (MARIO). Estimation of Copper Sulphate	ii, 762
UTZ (F.). Volumetric Estimation of Corrosive Sublimates in Dressings	ii, 762
ALLEN (EUGENE T.) and V. H. GOTTSCHALK. Estimation of Aluminium	ii, 762
CAMP (J. M.). Estimation of Alumina as Phosphate in Ore and Blast-furnace Cinder	ii, 763
HILLEBRAND (WILLIAM F.) and HENRY N. STOKES. Relative Values of the Mitscherlich and Hydrofluoric Acid Methods for the Estimation of Ferrous Iron	ii, 763
CARPENTER (F. B.). Estimation of Pyrrhotite in Pyrites Ore	ii, 763
MOORE (THOMAS). Estimation of Cobalt in New Caledonian Ores	ii, 764
MOORE (THOMAS). Separation and Estimation of Small Quantities of Cobalt in the Presence of Nickel	ii, 764
BROWNING (PHILIP E.) and JOHN B. HARTWELL. Qualitative Separation of Nickel from Cobalt by the Action of Ammonium Hydroxide on the Ferricyanides	ii, 765
MAWROW (F.). Separation of Cobalt and Nickel by means of Persulphates	ii, 765
MACIVOR (R. W. EMERSON). Analysis of Chrome-Iron Ore by the Borax Method	ii, 765
M'KENNA (ALEXANDER G.). Analysis of Chrome and Tungsten Steels	ii, 765
IBBOTSON (FRED) and HARRY BREARLEY. Estimation of Molybdenum in Steel and Steel-making Alloys	ii, 766
RÖSSLER (HEINRICH). Estimation of small quantities of Platinum in Gold	ii, 767
LEHMANN (MARTIN). Volumetric Estimation of Iodoform in Dressings	ii, 767
WENDER (NEUMAN) and GEORG GREGOR. Testing Lemonade Essences.	
I. Essence of Lemon and of Bitter Orange	ii, 767
FARNSTEINER (K.). Separation of Oleic Acid from other Unsaturated Acids	ii, 767
JEAN (FERDINAND). Estimation of Lactic Acid in the Commercial Article	ii, 767
ARNOLD (V.). Detection and Estimation of Acetoacetic Acid in Pathological Urine	ii, 768
SOURCE (LOUIS MAGNIER DE LA). Estimation of Potassium Hydrogen Tartrate in Wine	ii, 768
HILGER (ALBERT). Estimation of Malic Acid	ii, 768
HIS (WILHELM, jun.) and W. HAGEN. Uric Acid and Purine Bases in the Blood and Animal Organs	ii, 769
CONRADY (A.). Detection of Salicylic Acid in Presence of Citric Acid	ii, 769
LANGKOPF (OTTO). Detection of Salicylic Acid in Presence of Citric Acid	ii, 769
GEROCK (J. E.). Detection of Salicylic Acid in Presence of Citric Acid	ii, 769
KLETT (A.). Detection of Salicylic Acid in Presence of Citric Acid	ii, 770
SÜSS (P.). Detection of Salicylic Acid in Milk	ii, 770
BLUMENTHAL (FERDINAND). Estimation of Hippuric Acid	ii, 770
PENNY (CHARLES L.). A Multiple Fat Extractor	ii, 770
REINSCH (A.) and H. LÜHRIG. Variation in Milk Solids; Control of Milk Supply	ii, 771
LEACH (ALBERT E.). Estimation of Fat in Condensed Milk	ii, 771
GEISLER (JOSEPH F.). Estimation of Fat in Sweetened Condensed Milk	ii, 771
FARRINGTON (E. H.). Estimation of Fat in Sweetened Condensed Milk by the Babcock Test	ii, 771
SEYDA (ANTON). Estimation of the Volatile Acids in Butter by Leffmann-Beam's Glycerol-Soda Process	ii, 772

	PAGE
HANUŠ (JOS.) and ALB. STOOKÝ. Chemical Action of Mould on Butter . . .	ii, 772
OILAR (ROZIER D.). The Halphen Colour Test and its Value for the Detection of Cotton Seed Oil	ii, 772
DRIESSEN MAREEUW (W. P. H. VAN DEN). Maripa Fat	ii, 773
BORNTRÄGER (HUGO). Simple Analysis of Wool Fat	ii, 773
HANUŠ (JOS.). Estimation of Aldehydes by Means of Hydrazines. I. Estimation of Vanillin	ii, 773
BÖTTINGER (CARL). Detection of Aldehyde in Vinegar prepared by Ferment- ation	ii, 773
BURGESS (HERBERT E.). New Colour Reaction for Citral and certain other Aromatic Compounds	ii, 774
VITALI (DIOSCORIDE). Chemicotoxicology of Sulphonal and Analogous Compounds	ii, 774
BORNTRÄGER (HUGO). Analysis of Gutta Percha	ii, 775
HAFNER (B.). Estimation of Glycyrrhizin in Liquorice Extract	ii, 775
GREGOR (GEORG). Analysis of Cayenne Pepper	ii, 775
THAETER (KARL). Estimation of Santonin	ii, 775
WINTON (A. L.). Detection of Coal-Tar Dyes in Fruit Products	ii, 776
KLETT (A.). Detection of Indican in Pathological Urine	ii, 776
WESENBERG (G.). Ehrlich's Diazo-reaction	ii, 776
CARCANO (LUIGI). Ehrlich's Diazo-reaction for the Recognition of some recently introduced Morphine Derivatives	ii, 776
NAGELVOORT (J. B.). Assay of Opium	ii, 777
GORDIN (HARRY M.). Modified Alkalimetric Method for the Valuation of Opium, and other Pharmaceutical Drugs and Preparations that contain Alkaloids	ii, 777
KIPPENBERGER (CARL). Action of Iodine on Aconitine and Caffeine	ii, 777
HARKER (G.). Estimation of Nicotine. Amount of Nicotine in New South Wales Tobaccos	ii, 778
FARR (E. H.) and ROBERT WRIGHT. Estimation of Strychnine	ii, 778
COHNHEIM (OTTO) and H. KRIEGER. Behaviour of Proteids to Alkaloid Reagents, and a Method of Estimating Combined Hydrochloric Acid	ii, 778
BARNSTEIN (F.). Modification of Ritthausen's Method of Determining Proteids	ii, 779
SCHJERNING (HENRIK). Precipitation of Proteids	ii, 779

INDEX OF AUTHORS' NAMES.

A.

Adriani, J. H., i, 628.
 Afanaséeff, ii, 702.
 Allen, E. T., ii, 726.
 Allen, E. T., and V. H. Gottschalk,
 ii, 762.
 Allen, E. T., and H. F. Rogers,
 ii, 727.
 Alberda van Ekenstein, W., and
 C. A. L. de Bruyn, i, 619.
 Andrews, L. W., ii, 760.
 Angeli, A., and F. Angelico, ii, 722.
 Angelico, F., i, 675.
 Angelico, F. See also A. Angeli.
 Archbutt, L., ii, 756.
 Armstrong, E. F., i, 636.
 Arnold, V., ii, 768.
 Athanasescu, B. See A. Pictet.
 Austin, R. M. See L. Kahlenberg.

B.

Babcock, S. M., and H. L. Russell,
 i, 712.
 Baeyer, A. von, and V. Villiger,
 i, 626; ii, 719.
 Balbiano, L., and D. Trasciatti,
 i, 632.
 Bamberger, E., and J. Müller, i, 705.
 Barnstein, F., ii, 779.
 Barrie, T. S., ii, 755.
 Barth, G., ii, 746.
 Barthel, C., ii, 742.
 Batelli, A., and A. Stefanini, ii, 709.
 Bauer, H. See R. Stoermer.
 Baur-Thurgau, A., i, 639.
 Beck, R., ii, 734.
 Beckmann, E., ii, 701.
 Behn, H. See A. Michaelis.
 Beijerinck, M. W., i, 649.
 Bellucci, I. See A. Miolati.
 Bergell, P., i, 621.
 Berthault, ii, 753.

Berthelot, M., i, 620; ii, 740, 741.
 Besredka, ii, 741.
 Besredka. See also E. Metchnikoff.
 Bevan, E. J. See C. F. Cross.
 Bewad, I. I., i, 629.
 Biltz, H., i, 662.
 Bittner, K. See R. Wegscheider.
 Bitto, B. von, ii, 751.
 Blagden, J. W. See A. Hantzsch.
 Blake, R. F. See E. A. Letta.
 Blanckenhorn, M., ii, 736.
 Blattner, N., and J. Brasseur, ii, 755.
 Bleier, O., and L. Kohn, ii, 721.
 Blumenthal, F., ii, 770.
 Rodländer, G., ii, 715.
 Boekhout, F. W. J., ii, 742.
 Boes. See R. Stoermer.
 Böttinger, C., ii, 773.
 Bokorny, T., ii, 746.
 Bone, W. A., and C. H. G. Sprank-
 ling, *TRANS.*, 1298.
 Bordet, J., ii, 741.
 Bornträger, H., ii, 773, 775.
 Borsche, W., i, 645.
 Bose, E., ii, 704.
 Bougault, J., i, 641.
 Bran, F. See F. Haber.
 Brasseur, J. See N. Blattner.
 Braun, J. von, i, 641, 642, 644, 687.
 Brearley, H. See F. Ibbotson.
 Briggs, J. F. See C. F. Cross.
 Brochet, A., ii, 706.
 Browning, P. E., and J. B. Hartwell,
 ii, 765.
 Brüning, E. See A. Tschirch.
 Bruni, G., and F. Gorni, ii, 714.
 Bruyn, B. R. de. See A. F. Holle-
 man.
 Bruyn, C. A. L. de, ii, 717.
 Bruyn, C. A. L. de. See also W.
 Alberda van Ekenstein.
 Buchanan, J. Y., ii, 710.
 Bülow, C., i, 690.
 Burgess, H. E., ii, 774.
 Busch, M., and B. Weiss, i, 699.
 Butkewitsch, W., ii, 744.

C.

Camp, J. M., ii, 756, 757, 763.
 Campetti, A., ii, 704.
 Cantacuzène, J., ii, 741.
 Carcano, L., ii, 776.
 Carpenter, F. B., ii, 763.
 Casali, A., ii, 754.
 Cazeneuve, P., and P. Sisley, i, 701.
 Chattaway, F. D., and K. J. P. Orton,
 i, 643; ii, 722.
 Chattaway, F. D., and H. P. Stevens,
 ii, 722.
 Christensen, J. C., i, 626.
 Christmas, J. de, ii, 742.
 Cohen, E., ii, 702, 703, 716.
 Cohen, E., and H. Raken, ii, 725.
 Cohen, E. W., ii, 736.
 Cohn, P., and A. Fischer, i, 690.
 Cohnheim, O., and H. Krieger, ii, 778.
 Colman, J. See S. Gabriel.
 Conrad, A., ii, 769.
 Cordier, V. von, ii, 723.
 Crépieux, P. See F. Reverdin.
 Crivelli, C., and S. von Kostanecki,
 i, 668.
 Cross, C. F., E. J. Bevan, and J. F.
 Briggs, i, 682.
 Curtius, T., i, 698, 700.
 Curtius, T., and A. Lublin, i, 700.
 Curtius, T. [and H. Melsbach], i, 701.
 Cushman, A. S., ii, 725.
 Czerny, H., i, 675.

D.

Decker, H., i, 688, 689, 689.
 Dieckmann, W., i, 623.
 Divine, R. E., ii, 759.
 Doerstling, P., ii, 752.
 Doward, E., i, 676.
 Driessen-Mareeuw, W. P. H. van
 den, ii, 773.
 Duden, P., and A. E. Macintyre [and
 J. Robertson], i, 674.
 Duden, P., and W. Treff [and D.
 Heynsius], i, 671.
 Dünensberger, E. See C. Hartwich.
 Dufau, E., ii, 728.
 Duhem, P., ii, 708.
 Dunstan, W. R., and E. Goulding,
 TRANS., 1262.

E.

Emmerich, W. See A. Wohl.
 Emmerling, O., ii, 742.
 Erben, F., ii, 739.

Erlenmeyer, E., jun., i, 649.
 Euler, W., ii, 760.

F.

Faltin, A. See T. Kosutány.
 Farustein, K., ii, 767.
 Farr, E. H., and R. Wright, ii, 778.
 Farrington, E. H., ii, 771.
 Fenton, H. J. H., TRANS., 1294.
 Fertig, E. See L. Wolff.
 Feuerstein, W. See E. Noelting.
 Finckh, von. See R. Stoermer.
 Findlay, A., ii, 716.
 Fischer, A. See P. Cohn.
 Fischer, E., i, 646.
 Fischer, E., and W. von Loben,
 i, 697.
 Fischer, E., and A. Mouneyrat,
 i, 647.
 Fischer, H. See E. H. Miller.
 Flatow, L. See C. Liebermann.
 Fonze-Diacon, H., ii, 730.
 Franchimont, A. P. N., i, 680.
 Frankforter, G. B., ii, 747.
 Fraps, G. S., i, 645; ii, 748, 754.
 Freitag, H., ii, 708.
 French, W., ii, 718.
 Fresenius, W., ii, 754.
 Freudenreich, E. von, i, 712.
 Friderich, L. See P. A. Guye.

G.

Gabriel, S., and J. Colman, i, 689.
 Gallinek, A., i, 697.
 Gautier, A., ii, 720.
 Geissler, J. F., ii, 771.
 Gerilowski, D. W., i, 706.
 Gerin, F. See L. Vignon.
 Gerock, J. E., ii, 769.
 Geuns, J. W. van, i, 636.
 Gladstone, J. H., ii, 710.
 Göckel, A., ii, 704.
 Goldstein, E., ii, 702.
 Goodchild, J. G., ii, 733.
 Gordin, H. M., i, 683; ii, 777.
 Gorni, F. See G. Bruni.
 Goto, M., ii, 740.
 Gotsch, F. See F. Kunckell.
 Gottschalk, V. H. See E. T. Allen.
 Goulding, E. See W. R. Dunstan.
 Gräfenhan. See R. Stoermer.
 Gräler, K. P. See R. Stoermer.
 Gregor, G., ii, 775.
 Gregor, G. See also N. Wender.
 Greimer, K., i, 683.
 Gross. See R. Stoermer.

Grossmann, S., and S. von Kosta-
necki, i, 689.
Grousinoﬀ, A. A., ii, 720.
Guépin, H., ii, 751.
Guye, P. A., and L. Friderich,
ii, 709.

H.

Haber, F., ii, 720.
Haber, F., and F. Bran, ii, 720.
Hafner, B., ii, 775.
Hagen, W. See W. His, jun.
Hanamann, J., ii, 752.
Hantzsch, A., i, 618, 702.
Hantzsch, A. and J. W. Blagden,
i, 704.
Hantzsch, A. [G. Osswald, W. Sem-
ple, and J. Spear], i, 708.
Hanuš, J., ii, 778.
Hanuš, J., and A. Stocký, ii, 772.
Harker, G., ii, 778.
Harlay, V., ii, 744.
Hartong Van Ark, H. See E.
Schmidt.
Hartwell, J. B. See P. E. Browning.
Hartwich, C., and E. Dünenberger,
ii, 747.
Hauser, O., and L. Vanino, i, 641.
Hauser, O. See also L. Vanino.
Hawthorn, J. See E. A. Letta.
Haywood, J. K., ii, 758.
Hecker, G. See F. Kunckell.
Heinrich, G., ii, 707.
Helbig, M. See R. Stoermer.
Hellwig, K., ii, 723.
Hemptinne, A. de, ii, 707.
Hérics-Tóth, E. von. See T.
Kosutány.
Hermes. See R. Stoermer.
Herz, W., ii, 728.
Hewitt, J. T., and B. W. Perkins,
TRANS., 1324.
Heyn, E., ii, 728.
Heynsius, D. See P. Duden.
Hiepe, E. See A. Tschirch.
Hildebrandt, H., i, 686.
Hilgard, E. W., ii, 758.
Hilger, A., i, 682; ii, 768.
Hillebrand, W. F., and H. N.
Stokes, ii, 768.
His, W., jun., and W. Hagen, ii, 769.
Hirsch, H., i, 670.
Hittorf, W., ii, 705.
Höber, R., ii, 738.
Hofmann, K. A., and J. Sand, i, 618.
Holleman, A. F., and B. R. de Bruyn,
i, 638.
Horsfall, L. H. See A. G. Perkin.
Hotter, E., ii, 745.

Hougardy, i, 709.
Hyde, H. St. J. See H. C. Sherman.

I.

Ibbotson, F., and H. Brearley,
ii, 757, 766.
Ittner, M. H., ii, 718.

J.

Jacoby, M., i, 711.
Jaeger, W., and S. Lindeck, ii, 703.
Jahn, H., ii, 707.
Jean, F., ii, 767.
Johnson, T. B. See H. L. Wheeler.
Jowett, H. A. D., i, 686.

K.

Kahlenberg, L., and R. M. Austin,
ii, 747.
Kassner, G., ii, 725.
Katzer, F., ii, 733.
Kenrick, F. B. See W. L. Miller.
Kerschbaum, M. See F. Tiemann.
Kijner, N. M., i, 629.
Kinch, E. TRANS., 1271.
Kippenberger, C., ii, 777.
Kissel. See R. Stoermer.
Kissel, J., i, 620.
Klason, P., i, 676.
Klett, A., ii, 770, 776.
Klimenko, B. See S. Tanatar.
Klöcker, A., ii, 743.
Kloos, J. H., ii, 733.
Knieriem, W. von, ii, 748, 749.
Koenig, G. A., ii, 718.
Koert, W., ii, 734.
Koettnitz, C. See D. Vorländer.
Kohlhammer, E. See A. Pinner.
Kohlrausch, F., ii, 712.
Kohn, L. See O. Bleier.
Kostanecki, S. von, and A. Seifart,
i, 668.
Kostanecki, S. von. See also C.
Crivelli, S. Crossmann.
Kosutány, T., E. von Hérics-Tóth,
L. von Széll, and A. Faltin, ii, 750.
Kourimsky, L., ii, 752.
Kowalewsky, W. von, ii, 731.
Kozai, Y., ii, 743.
Kraemer, G., and A. Spilker,
i, 617, 656.
Krieger, H. See O. Cohnheim.
Krügel, C. See A. Ladenburg.
Krüger, F., ii, 706.
Kunckell, F., i, 664.
Kunckell, F., and F. Gotsch, i, 638.

Kunckell, F., G. Hecker, and G. Treutler, i, 663.

L.

Laar, J. J. van, ii, 708.
Ladenburg, A., ii, 721.
Ladenburg, A., and C. Krügel ii, 723.
Landau, J., i, 661, 667.
Lang, R., ii, 707.
Langkopf, O., ii, 769.
Lanser, T., and F. Wiedermann, i, 666.
Lawroff, D., ii, 741.
Leach, A. E., ii, 771.
Lebeau, P., ii, 729.
Lehmann, M., ii, 767.
Lemmermann, O. See T. Pfeiffer.
Letts, E. A., and R. F. Blake, ii, 755.
Letts, E. A., and J. Hawthorn, ii, 747.
Lewis, P., ii, 701, 702.
Ley, H., ii, 731.
Liebmann, C., and L. Flatow, i, 667.
Liebmann, C., and C. N. Riiber, i, 648.
Linck, G., ii, 717.
Lindeck, S. See W. Jaeger.
Lingle, D. J., ii, 739.
Loben, W. von. See E. Fischer.
Löb, W., i, 697, ii, 706.
Lövinson, O., ii, 744, 745.
Lovisato, D., ii, 736.
Lublin, A. See T. Curtius.
Lührig, H. See A. Reinsch.
Lüttringhaus, A. See L. Wolff.
Luther, R. and D. R. Wilson, ii, 705.
Lutzu, G. von. See R. E. Meyer.

M.

Maas, O., i, 708.
Macintyre, A. E. See P. Duden.
Mac Ivor, R. W. E., ii, 765.
M'Kenna, A. G., ii, 765.
Magnier de la Source, L., ii, 768.
Matthews, F. E., TRANS., 1273.
Mawrow, F., ii, 765.
Medvedeff, A., ii, 738.
Meigen, W., and W. Normann, i, 702.
Melsbach, H. See T. Curtius.
Mennicke, H., ii, 761.
Merrill, G. P., and H. N. Stokes, ii, 737.
Metchnikoff, É., ii, 741.

Metchnikoff, É., and Besredka, ii, 741.
Meyer, R. E., i, 660.
Meyer, R. E., and G. von Lutzu, i, 643.
Meyer, R. E., and J. Szanecki, i, 660.
Michaelis, A., and H. Behn, i, 693.
Michaelis, A., and G. Schwabe, i, 695.
Michaelis, A., and H. T. Sudendorf, i, 696.
Michel, F., i, 669.
Mie, G., ii, 703.
Migula, W., ii, 744.
Miller, E. H., and H. Fisher, ii, 761.
Miller, W. L., and F. B. Kenrick, ii, 703.
Miolati, A., and I. Bellucci, ii, 732.
Mixer, W. G., i, 618.
Moissan, H., ii, 726.
Momsen, C. See E. Ramm.
Moore, B., and C. O. Purinton, ii, 737.
Moore, T., ii, 764.
Moses, N., i, 658.
Moszeik, F. See T. Pfeiffer.
Mouilpied, A. T. de. See D. Vorländer.
Mouneyrat, A., i, 644.
Mouneyrat, A. See also E. Fischer.
Müller, F., i, 677.
Müller, J. See E. Bamberger.
Mukerji, P., ii, 756.
Mulder, E., ii, 724.
Murrill, P., and J. O. Schlotterbeck, i, 636.

N.

Naegeli, O., ii, 741.
Nagelvoort, J. B., ii, 777.
Neucki, M., and J. Zaleski, i, 709.
Nerking, J., ii, 740.
Naef, E. See F. Ulmann.
Nernst, W., ii, 706.
Neubauer, H., ii, 759.
Niemczycki, S., i, 636.
Noelting, E., and W. Feuerstein, ii, 722.
Nolf, P., ii, 741.
Normann, W. See W. Meigen.
Noyes, W. A., and E. F. Philips, i, 622.

O.

Oesterlin, C. See A. Wohl.
Offergeld, H. See B. Schöndorff.
Oilar, R. D., ii, 772.

Orton, K. J. P. See F. D. Chataway.
 Osswald, G. See A. Hantzsch.
 Ostwald, W., ii, 712, 730.
 Otto, R., ii, 763.

P.

Paderi, C., ii, 742.
 Panormoff, A. A., i, 709.
 Parr, S. W., ii, 710, 762.
 Paternò, E., i, 662.
 Penny, C. L., ii, 770.
 Perkin, A. G., and L. H. Horsfall, TRANS., 1310, 1314.
 Perkins, B. W. See J. T. Hewitt.
 Pettersson, O., TRANS., 1277.
 Pfeiffer, P., i, 688.
 Pfeiffer, T., ii, 751.
 Pfeiffer, T., F. Moszeik, and O. Lemmermann, ii, 753.
 Phillips, E. F. See W. A. Noyes.
 Pictet, A., i, 685.
 Pictet, A., and B. Athanasescu, i, 685.
 Pictet, A., and A. Rotschy, i, 685.
 Piepes-Poratyński, J., i, 648.
 Pinner, A., and E. Kohlhammer, i, 685.
 Polacco, R. See A. Tschirch.
 Pommerhne, H., i, 684.
 Poni, P., i, 617.
 Purinton, C. O. See B. Moore.

R.

Raken, H. See E. Cohen.
 Ramberg, L., ii, 717.
 Ramm, E., ii, 749.
 Ramm, E., and C. Momsen, ii, 750.
 Rauwerda, A., i, 684.
 Reinders, W., ii, 715, 731.
 Reinsch, A., and H. Lührig, ii, 771.
 Reverdin, F., and P. Crépieux, i, 638, 644, 701.
 Richter, O. See R. Stoermer.
 Riiber, C. N. See C. Liebermann.
 Rimatori, C., ii, 735.
 Robertson, J. See P. Duden.
 Rössler, H., ii, 732.
 Rogers, H. F. See E. T. Allen.
 Romburgh, P. van, i, 677.
 Roozeboom, H. W. B., ii, 728.
 Rosenheim, O. See F. W. Tunnicliffe.
 Rotschy, A. See A. Pictet.
 Russell, H. L. See M. S. Babcock.

S.

Salkowski, E. L., i, 628; ii, 740.
 Sammogia, M., ii, 750.
 Sand, J. See K. A. Hofmann.
 Saposchnikoff, A. V., ii, 722.
 Saulman, F., i, 687.
 Schellhorn, B. See W. Windisch.
 Schiff, H. See A. Wohl.
 Schjerning, H., ii, 779.
 Schlossberg, S., i, 665.
 Schlotterbeck, J. O., ii, 746.
 Schlotterbeck, J. O. See also P. Murrill.
 Schmalzhofer, F. X., i, 626.
 Schmidt, E., and H. Hartong van Ark, i, 686, 687.
 Schöndorff, B. [and H. Offergeld] ii, 740.
 Schreckenberger, P. See R. Stoermer.
 Schukoff, I., i, 628.
 Schulze, E., ii, 745.
 Schwabe, G. See A. Michaelia.
 Schwantke, A., i, 711.
 Seifart, A. See S. von Kostanecki.
 Semmler, F. W., i, 676.
 Sempie, W. See A. Hantzsch.
 Seyda, A., ii, 772.
 Seyewetz, A., i, 645.
 Shedden, F., i, 683.
 Sherman, H. C., and H. St. J. Hyde ii, 757.
 Simon, L. J., i, 624.
 Simonis, H., and G. Wenzel, i, 648.
 Sisley, P. See P. Cazeneuve.
 Sjögren, H., ii, 734.
 Smits, A., ii, 708.
 Soden, H. von, i, 677.
 Southerden, F. See F. W. Stretefeld.
 Spear, J. See A. Hantzsch.
 Spiegel, L., ii, 754.
 Spilker, A. See G. Kraemer.
 Sprankling, C. H. G. See W. A. Bone.
 Spring, W., ii, 713.
 Stefanini, A. See A. Batelli.
 Stephan, K. See H. Walbaum.
 Stevens, H. P. See F. D. Chataway.
 Stobbe, H., i, 659.
 Stocký, A. See J. Hanuš.
 Stoeckl, K., and L. Vanino, ii, 713.
 Stoermer, R., H. Bauer, Boez, von Finekh, Gräfenhan, K. P. Gräler, Gross, M. Helbig, Hermes, Kissel, O. Richter, P. Schreckenberger, and A. Tenedeloff, i, 650.

Stokes, H. N. See W. F. Hillebrand
and G. P. Merrill.
Streatfeild, F. W., and F. Sou-
therden, ii, 718.
Sudendorf, H. T. See A. Michaelis.
Süss, P., ii, 759, 770.
Swarts, F., i, 637.
Szanecki, J. See R. E. Meyer.
Széll, L. von. See T. Kosutány.

T.

Tammann, G., ii, 714.
Tanatar, S., and B. Klimenko,
ii, 713.
Tasselli, E., ii, 750.
Tayler, J. B., ii, 710.
Termier, P., ii, 735.
Tendeloff, A. See R. Stoermer.
Thaeter, K., ii, 775.
Thoms, H., i, 622.
Tiemann, F., and M. Kerschbaum,
i, 624.
Tingle, A., i, 641.
Trasciatti, D. See L. Balbiano.
Treff, W. See P. Duden.
Treutler, G. See F. Kunckell.
Trowbridge, J., ii, 701.
Tschirch, A., and E. Brüning,
i, 678.
Tschirch, A., and E. Hiepe, i, 681.
Tschirch, A., and R. Polacco, i, 681.
Tschirch, A., and G. Weigel, i, 679,
680.
Türin, V., von, ii, 712.
Tunncliffe, F. W., and O. Rosen-
heim, i, 636.
Tyler, C. T., and A. Wertheimer,
i, 676.

U.

Ullmann, F., and E. Naff, i, 689.
Ullmann, F., and P. Wenner, i, 619.
Utz, F., ii, 762.

V.

Vanino, L., and O. Hauser, ii, 722.
Vanino, L. See O. Hauser, K.
Stoeckl.
Vignon, L., i, 623, 629.
Vignon, L., and F. Gerin, i, 629.
Villiger, V. See A. von Baeyer.
Vitali, D., ii, 774.
Vogt, J. H. L., ii, 734
Vongerichten, E., i, 681.

Vorländer, D., and C. Koettnitz,
i, 649.
Vorländer, D., and A. T. de Mouil-
pied, i, 644.

W.

Wade, E. M., and M. L. Wade,
ii, 758.
Walbaum, H., i, 645.
Walbaum, H., and K. Stephan,
i, 677.
Warburg, E., ii, 721.
Warth, H., ii, 723.
Wavelet, ii, 758.
Wedekind, E., i, 665.
Wedenski, N. E., ii, 739.
Wegscheider, R., i, 657.
Wegscheider, R., and K. Bittner,
i, 658.
Wehmer, C., ii, 743.
Weigel, G. See A. Tschirch.
Weigert, R., ii, 738.
Weisberg, J., i, 628.
Weiss, B. See M. Busch.
Wender, N., and G. Gregor, ii, 767.
Wenner, P. See F. Ullmann.
Wenzel, G. See H. Simonis.
Wertheimer, A. See C. T. Tyler.
Weisenberg, G., ii, 776.
Wheeler, H. L., and T. B. Johnson,
i, 632.
Weidemann, F. See T. Lanser.
Wilson, D. R. See R. Luther.
Wilson, H. A., ii, 712.
Windisch, W., and B. Schellhorn,
i, 712.
Winton, A. L., ii, 776.
Wohl, A., i, 698.
Wohl, A., and W. Emmerich, i, 627.
Wohl, A., and C. Oesterlin, ii, 698.
Wohl, A., and C. Schiff, i, 706.
Wolff, J. E., ii, 735.
Wolff, L. [E. Fertig and A. Lüt-
tringhaus], i, 691.
Woringer, B., ii, 709.
Wright, R. See E. H. Farr.

Y.

Young, S., ii, 711.

Z.

Zaleski, J. See M. Nencki.
Zawidzki, J. von, ii, 713
Zecchini, M., ii, 762.
Zeynek, R. von, 711.

ERRATA.

VOL. LXXVII (TRANS., 1900).

Page	Line	
982	20	} for "litmus" read "lacmoid paper."
983	11	
982	5*	after "then" insert " , after neutralisation."

* From bottom.

in their nomenclature, *Nitrochinon-Phenylhydrazon*) gives neither hydrate nor hydrochloride. The existence of the sulphate shows, however, that the azophenol is capable of forming salts with strong acids.

Solutions of the azophenol in fixed alkalis and ammonia are of a distinct red shade, in fact, the difference of colour between the free phenol and its alkaline salts strongly recalls the relationship in colour between *o*-nitrophenol and its alkali salts. The sodium salt separates in red needles on concentration, and in neutral solution gives, with solutions of metallic salts, the following precipitates.

Silver Nitrate.—Light orange precipitate, practically insoluble, even in boiling water.

Magnesium Chloride.—Orange precipitate, dissolves somewhat in boiling water, and separates in groups of small needles on cooling.

Zinc Sulphate.—Bright yellow precipitate, becoming crystalline on warming, slightly soluble in boiling water.

Cadmium Sulphate.—Orange precipitate, very slightly soluble.

Mercuric Chloride.—Yellow precipitate, appreciably soluble in boiling water.

Calcium Chloride.—Orange red precipitate, very slightly soluble in boiling water.

Strontium Chloride.—Similar precipitate to that with calcium chloride, but somewhat redder in shade.

Barium Chloride.—Scarlet precipitate, very sparingly soluble in boiling water, from which it separates in very slender, long needles.

Lead Acetate.—Orange precipitate, insoluble.

Copper Sulphate.—Dirty orange precipitate, insoluble.

Cobalt Nitrate or *Nickel Chloride*.—Reddish-brown precipitate.

Manganese Sulphate.—Orange precipitate, somewhat soluble in boiling water.

Stannous Chloride.—Bright sulphur-yellow precipitate.

Ferrous Sulphate.—Dark brown precipitate, soon turning green.

Ferric Chloride.—Bright sulphur-yellow precipitate.

Aluminium Sulphate.—Bright yellow precipitate.

Chrome Alum.—Yellow precipitate, not quite so clear in shade as that with aluminium.

It is somewhat striking that the colours of the precipitates should vary so much. The very slight solubility of the barium salt contrasts strongly with that of the barium salts of benzeneazophenols containing the substituents in the benzene nucleus, which may be recrystallised easily from boiling water and are obtained as orange needles containing $4\text{H}_2\text{O}$.

The *acetyl* derivative, $\text{C}_6\text{H}_5\cdot\text{N}:\text{N}\cdot\text{C}_6\text{H}_3(\text{NO}_2)\cdot\text{O}\cdot\text{CO}\cdot\text{CH}_3$, is easily

obtained by warming 2 parts of the azophenol, 2 parts of fused powdered sodium acetate, and 5 parts of acetic anhydride for 1 hour on the water-bath. It separates in a flocculent state on pouring into water, and may be obtained as yellowish-brown prisms by recrystallisation from glacial acetic acid or benzene. It melts at 120.5° .

0.1237 gave 0.2644 CO_2 and 0.0428 H_2O . $\text{C} = 58.29$; $\text{H} = 3.85$.

0.1103 „ 14.5 c.c. moist nitrogen at 21° and 756 mm. $\text{N} = 14.89$.

$\text{C}_{14}\text{H}_{11}\text{O}_4\text{N}_3$ requires $\text{C} = 58.90$; $\text{H} = 3.89$; $\text{N} = 14.77$ per cent.

The acetyl derivative is easily soluble in acetone, ethyl acetate, or pyridine, less so in chloroform or benzene; methylated spirit dissolves it sparingly in the cold, but fairly readily on warming, as does amyl alcohol. It is sparingly soluble in ether and insoluble in light petroleum.

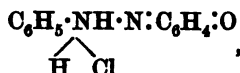
The *benzoyl* derivative, $\text{C}_6\text{H}_5\cdot\text{N}:\text{N}\cdot\text{C}_6\text{H}_5(\text{NO}_2)\cdot\text{O}\cdot\text{CO}\cdot\text{C}_6\text{H}_5$, is obtained when equal weights of the azophenol and benzoyl chloride are boiled gently for 1 hour. After pouring the product into water and leaving it until it has solidified, it is powdered, warmed with a little alcohol, and washed with repeated small quantities of cold alcohol on the pump. It separates from benzene in small, yellow crystals, melts at 132° , is easily soluble in hot benzene, acetone, or chloroform, sparingly so in alcohol or light petroleum, and is only dissolved in very small quantities by ether.

0.1127 gave 12.4 c.c. moist nitrogen at 13° and 764 mm. $\text{N} = 13.07$.

$\text{C}_{19}\text{H}_{13}\text{O}_4\text{N}_3$ requires $\text{N} = 12.72$ per cent.

The difference in the behaviour of benzeneazophenol on nitration, when the operation is effected with dilute acid or in concentrated sulphuric acid solution, might be explained if benzeneazophenol had the constitution, $\text{C}_6\text{H}_5\cdot\text{N}:\text{N}\cdot\text{C}_6\text{H}_4\cdot\text{OH}$, usually assigned to it.

Phenols undergo substitution much more readily than benzene derivatives, in which no hydroxyl or amino-groups are present, and hence nitration might be expected to occur in the phenol nucleus. On the other hand, when nitration takes place in a sulphonic acid solution, a salt of the azophenol with a mineral acid is being nitrated, and if to these salts a formula is assigned, such as that which Hantzsch (*Ber.*, 1899, 32, 3091) gives to the hydrochloride,



the result is also easily explicable. Quinones are substituted with comparative difficulty, amines, on the contrary, with ease, an ortho- or a para-derivative being produced. Hantzsch, however, assigns a similar

quinonoid structure to the free azophenols, and this seems to be hardly reconcilable with the experiments just described. It may be pointed out that the colour of the free azophenols much more closely corresponds to that of their ethers and esters, which undoubtedly possess the azo-structure, than to that of their salts with mineral acids for which the structure of quinone-hydrazone derivatives is probable.

The author desires to thank Messrs. Clacher and Likiernik for help afforded in this work.

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hard glass tube. A mixture of water and an insoluble oil was thus obtained, and the latter was separated, dried over sodium, and distilled ; it boiled practically constantly at $174\text{--}176^\circ$. On analysis :

0.2035 gave 0.6676 CO_2 and 0.1831 H_2O . C = 89.5 ; H = 9.9.

C_9H_{12} requires C = 90.0 ; H = 10.0 per cent.

The hydrocarbon was violently attacked by cold dry bromine, and after removing the excess of the latter by evaporation, a solid product was obtained which crystallised from alcohol in beautiful, glistening needles melting at $242\text{--}243^\circ$. The bromo-derivative gave the following result on analysis :

0.1575 gave 0.2510 AgBr. Br = 67.9.

Calculated for $\text{C}_9\text{H}_9\text{Br}_3$, Br = 67.3 per cent.

The properties of the hydrocarbon and its bromo-derivative indicated that it was hemimellitene or 1 : 2 : 3-trimethylbenzene. Jacobson (*Ber.*, 1886, 19, 2517) gives the boiling point of hemimellitene as $174\text{--}175.5^\circ$, and the melting point of the tribromo-derivative as 245° . In order to make the identification complete, the hydrocarbon was warmed with sulphuric acid, in which it dissolved readily, and after getting rid of the sulphuric acid by means of barium carbonate in the usual way, the barium salt of the sulphonic acid was converted into the sodium salt, and this, by treatment with phosphorus pentachloride and ammonia, was transformed into the sulphonamide. The latter is very characteristic, and crystallises in small, compact forms which aggregate together, producing long columns resembling prisms ; it melted sharply at 194° . Jacobson (*loc. cit.*) gives the melting point of hemimellitene sulphonamide as 196° .

The constitution of the hydrocarbon having thus been ascertained, no difficulty was found in identifying the acid from which it was obtained as prehnitylic acid or 2 : 3 : 4-trimethylbenzoic acid, as it agrees closely in melting point and general properties with the acid obtained by Jacobson from 1 : 2 : 3 : 4-tetramethylbenzene (*Ber.*, 1886, 19, 1214).

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CHEMICAL DEPARTMENT, SCHOOL OF PHARMACY,
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potassium hydrosulphide is formed on passage of hydrogen sulphide through a *hot* solution of K_4S_6 , and that the liberated sulphur, at the moment of its separation, is taken up by unaltered K_4S_6 , forming the higher compound K_4S_{10} .

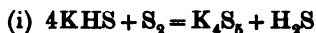
(3) It is to be noted that in all cases the polysulphide obtained is *richer* in sulphur than that for which the sulphur added was sufficient. This requires elucidation and two suggestions are made :

(a) All the sulphur added unites selectively with a *portion* only of the potassium hydrosulphide, forming a higher polysulphide than was designed in the experiment, and leaving potassium hydrosulphide in solution unaltered.

(b) That the formation of the higher polysulphide is due to the action of the current of hydrogen sulphide on the polysulphide first formed (see paragraph 2).

(4) It is evident on considering the results of experiments *a, e, f, g* (Series I), that it is not possible to discriminate between (a) the first product obtained on dissolving sulphur in potassium hydrosulphide, and (b) the condensing effect of the current of hydrogen sulphide on the polysulphide first formed.

(5) Attention may now be directed to the experiments of Series II, (see β, γ, δ), in which no current of hydrogen sulphide was employed. Turning to the experiment marked δ in the Table, the intention was to produce K_4S_6 , for which the sulphur added was sufficient. As a matter of fact, *the product obtained was K_4S_8 , and 50 per cent. of the hydrosulphide was found unaltered* after solution of the sulphur had been effected. The following equations represent (i) the action expected, (ii) the change which actually took place.



The validity of the latter equation seems to be established, for the proportion KHS/S on the left hand side was that existing in the experiment δ (see Table) ; and, of the three items on the right hand side, two were definitely established, the existence of K_4S_8 , and the survival unaltered of 50 per cent. of the original hydrosulphide. It would follow then, from the fact that this proportion remains unaltered, that, by natural selection, under the given experimental conditions, the relation of the reacting materials is not that of the latter equation, but the simpler one : $4KHS + S_6 = K_4S_8 + 2H_2S$.

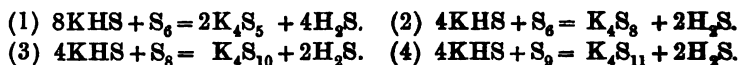
(6) As the result of treatment of crystals of K_4S_6 and K_4S_8 , with carbon disulphide, a lower polysulphide, $K_4S_6 \cdot 10H_2O$, has been obtained, which resists further removal of sulphur by this solvent.

Furthermore, K_4S_6 is a stable polysulphide, mustard-yellow in colour, easily and completely soluble in water, and in it the following relation

exists, $K_4S_2 \cdot S_8$, that is, of the five sulphur atoms, three are in the polysulphide position. There seems, then, good reason for suggesting that the *prime product*, in the case of potassium polysulphides, is *tetrapotassium pentasulphide*, K_4S_5 , and that the other crystalline polysulphides obtained are solid solutions of sulphur in this substance.

(7) Regard must also be paid to the fact that the polysulphides of ammonium and sodium are of the same degree of complexity, which seems to indicate that the source of this complexity is in the *sulphur molecule itself*. Now, it has long been held as a fact that sulphur, at temperatures above its boiling point, possesses a vapour density corresponding to a molecular formula of S_8 , and that only as the temperature rises to 860—1040°, does it conform to the type S_2 .* During the past few years also, certain papers have appeared dealing with the molecular weight of sulphur in solution (compare Paternò and Nasini, *Ber.*, 1888, 21, 2153; Beckmann, *Zeit. physikal. Chem.*, 1890, 5, 76; Hertz, *ibid.*, 1890, 6, 358; Guglielmo, *Real. Accad. Linc.*, 1892, ii, 210; Orndorff and Terrasse, *Amer. Chem. J.*, 1895, 18, 173), and as a result of this work, the molecule of sulphur is stated to exist in solution as S_8 , S_8 , or S_8 .

Now the simplest expressions that can be written involving the action of such molecular groupings, and limited by the observed experimental behaviour of potassium hydrosulphide, are as follows:



Of these reactions, (2) and (3) have been already obtained, but for (1) and (4) the experimental conditions are not yet known.

A small portion of this work was carried out at the Royal Naval College, Greenwich, with the aid of Dr. W. J. McKerrow, and the remainder in the Davy-Faraday Research Laboratory of the Royal Institution. The author's thanks are given to the Managers of the Royal Institution for this privilege, and to Dr. A. Scott for kindly criticism and advice received during the course of the investigation.

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* Biltz (*Ber.*, 1888, 21, 2013) does not, however, consider that the existence of gaseous molecules S_8 can be established. He finds the vapour density varies *gradually* with the temperature.

as Caro has stated that he is engaged in completing his discovery, we have not thought it right to extend our experiments in this direction. We may mention, however, that solutions containing a very large proportion of the peroxidised acids may be obtained, not only by electrolysing solutions of sulphuric acid, but also by mixing sulphuric acid with hydrogen peroxide, and then concentrating by freezing out the hydrate $\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$.

If our conclusion be accepted, it will follow that the account given by Berthelot, and, in fact, by all who have studied the acid, applies to 'pertetrasulphuric acid' rather than to 'perdisulphuric acid,' which appears under all conditions to be by far the minor product and the less stable, although its salts are more stable than those of 'pertetrasulphuric acid.' The production of 'perdisulphates' on electrolysing solutions of acid sulphates, whilst solutions of sulphuric acid yield chiefly 'pertetrasulphates,' is of interest as an indication that the electrolysis proceeds on very different lines in the two cases.

Attention may also be directed to the fact that, inasmuch as the persulphuric acids are formed by the interaction of sulphuric acid and hydrogen peroxide, it is clear that the affinity of hydrogen peroxide must be greater than that of water for sulphuric anhydride.

In conclusion, the authors desire to express their thanks to Dr. Armstrong, at whose suggestion the research was carried out, and to whom they are indebted for much valuable help during the whole course of the work.

CHEMICAL DEPARTMENT,
CENTRAL TECHNICAL COLLEGE,
EXHIBITION ROAD, LONDON, S. W

[It is proposed to extend the method here described to the study of the peroxides of other acids. H. E. A.]

0.1109 gave 0.2002 CO₂ and 0.0724 H₂O. C = 49.24; H = 7.25.

C₁₅H₂₆O₆S₂ requires C = 49.18; H = 7.10 per cent.

0.4296 gram made up to 25.1 c.c. with water, gave $\alpha_D + 0.49^\circ$ in a 200 mm. tube. Whence $[\alpha]_D + 14.3^\circ$ and $[M]_D + 52.4^\circ$.

0.3843 gram made up to 25.2 c.c. with water, gave $\alpha_D + 0.43^\circ$ in a 200 mm. tube. Whence $[\alpha]_D + 14.1^\circ$ and $[M]_D + 51.6^\circ$.

Since we have previously shown (Trans., 1899, 75, 1086) that the *d*-camphorsulphonic ion has $[M]_D + 51.7^\circ$ in aqueous solution, the conclusion that we were here dealing with a pure salt and that no resolution of the base had occurred seemed justified. In order, however, to obtain further evidence, the investigation of this and the salt next described was continued as stated in our preliminary note in February (*loc. cit.*), and the more so in that our work on tin published in May (Proc., 1900, 16, 116) seemed to bear upon the points at issue. During these intervening months, larger quantities of the salt have been prepared and subjected to prolonged fractional crystallisation, with the result that a resolution has been effected. On fractionally crystallising the salt some 40 or 50 times from a mixture of absolute alcohol and ether, a sparingly soluble fraction was obtained which melted at 118–120°, and gave the following results on analysis, &c., after drying at 100°:

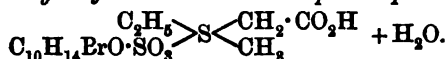
0.1275 gave 0.2304 CO₂ and 0.0839 H₂O. C = 49.27; H = 7.31.

C₁₅H₂₆O₆S₂ requires C = 49.18; H = 7.10 per cent.

0.7224 gram made up to 25.1 c.c. with water, gave $\alpha_D + 1.07^\circ$ in a 200 mm. tube. Whence $[\alpha]_D + 18.6^\circ$ and $[M]_D + 68.0^\circ$.

This material hence seems to be *d*-methylethylthetine *d*-camphorsulphonate, in which the anion has the molecular rotatory power $[M]_D + 16.3^\circ$.

d-Methylethylthetine *d*-Bromocamphorsulphonate,



On treating methylethylthetine bromide with silver *d*-bromocamphorsulphonate (Trans., 1899, 75, 1131) in place of the camphorsulphonate, but adopting otherwise the same procedure, an oily residue ultimately remains which readily solidifies in a vacuum desiccator. This, after several crystallisations from slightly moist acetone, is obtained as a mass of colourless, silky needles melting at 166–168°, and from analysis and rotatory power determinations appears to be a uniform product.

1.7103 lost 0.0571 at 100°. H₂O = 3.34.

0.2455 gave 0.3478 CO₂ and 0.1157 H₂O. C = 38.64; H = 5.22.

C₁₅H₂₆O₆BrS₂·H₂O requires H₂O = 3.88; C = 38.87; H = 5.83 per cent.

0.3533 gram made up to 25.0 c.c. with water, gave $\alpha_D + 1.68^\circ$ in a 200 mm. tube. Whence $[\alpha]_D + 59.5^\circ$ and $[M]_D + 275^\circ$.

Since the molecular rotatory power of the *d*-bromocamphorsulphonic ion is about $[M]_D + 270$ (Walden, *Zeit. physikal. Chem.*, 1894, 15, 196), it seemed that no resolution of the thetine had taken place. Prolonged fractional crystallisation of larger preparations of the salt from moist acetone resulted, however, in the separation of a sparingly soluble fraction having a molecular rotatory power slightly different from the above, although its composition is the same; about 30 crystallisations were undertaken in obtaining this product.

1.8654 lost 0.0666 at 100°. $H_2O = 3.57$; $1H_2O = 3.88$ per cent.

0.2385, dried at 100°, gave 0.3513 CO_2 and 0.1243 H_2O . $C = 40.17$; $H = 5.79$.

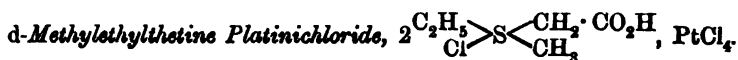
0.2293, dried at 100°, gave 0.3372 CO_2 and 0.1172 H_2O . $C = 40.10$; $H = 5.67$.

$C_{15}H_{25}O_6BrS_2$ requires $C = 40.44$; $H = 5.61$ per cent.

0.6172 gram air-dried salt, made up to 25.1 c.c. with water, gave $\alpha_D + 3.05^\circ$ in a 200 mm. tube. Whence $[\alpha]_D + 62.0^\circ$ and $[M]_D + 287^\circ$.

0.6594 gram air-dried salt, made up to 25.1 c.c. with water, gave $\alpha_D + 3.29^\circ$ in a 200 mm. tube. Whence $[\alpha]_D + 62.7^\circ$ and $[M]_D + 290.5^\circ$.

Since ammonium *d*-bromocamphorsulphonate has $[M]_D + 275^\circ$ in aqueous solutions of about the same molecular concentration as is here used, the examination of the thetine bromocamphorsulphonate, as well as the camphorsulphonate, affords very strong evidence that both contain an optically active thetine of which the ion has about $[M]_D + 15^\circ$.



On dissolving *d*-methylethylthetine *d*-camphorsulphonate of $[M]_D + 68^\circ$ or *d*-bromocamphorsulphonate of $[M]_D + 287^\circ$ to $+290^\circ$ in absolute alcohol, adding a little concentrated hydrochloric acid and then slowly stirring in an alcoholic solution of the requisite weight of platinic chloride, a yellow, crystalline platinichloride is deposited, which, after exhaustive washing with absolute alcohol, melts with profound decomposition at $177-180^\circ$. The salt is very soluble in water, but insoluble in absolute alcohol, and may be crystallised from dilute alcohol; its racemic isomeride is described by Carrara (*loc. cit.*) as melting at 167° .

0.2469 gave 0.1619 CO_2 and 0.0802 H_2O . $C = 17.89$; $H = 3.61$.

0.1104 „ 0.1391 $AgCl$. $Cl = 31.19$.

0.3558 „ 0.1015 Pt . $Pt = 28.53$.

$C_{10}H_{22}S_2O_4PtCl_6$ requires $C = 17.73$; $H = 3.25$; $Cl = 31.42$; $Pt = 28.71$ per cent.

0.2005 gram of salt from camphorsulphonate, made up to 15 c.c. with water, gave $\alpha_D + 0.14^\circ$ in a 200 mm. tube. Whence $[\alpha]_D + 4.6^\circ$ and $[M]_D + 30.8^\circ$.

0.3710 gram of salt from bromocamphorsulphonate, made up to 15 c.c. with water, gave $\alpha_D + 0.22^\circ$ in a 200 mm. tube. Whence $[\alpha]_D + 4.5^\circ$ and $[M]_D + 30.2^\circ$.

The molecular rotatory power $[M]_D + 30.5^\circ$ of the platinichloride is, as would be expected, just about twice that of the thetine ion, $[M]_D + 15^\circ$, deduced from its salts with optically active acids; in spite, however, of this close numerical agreement, we can as yet offer no guarantee that these optically active materials are free from their stereochemical isomerides.

We have thus proved that the asymmetric quadrivalent sulphur atom acts as a centre of optical activity just as does the carbon atom. Since we have previously demonstrated that the same is true of the asymmetric nitrogen (Trans., 1899, 75, 1127) and tin (Proc., 1900, 16, 42 and 116) atoms, we are now justified in concluding that the quadrivalent elements, C, Si, Ti, Zr, Ce, Th, Ge, Sn, Pb, O, S, Se, Te, Cr, Mo, W, and U of groups IV and VI, and the quinquivalent elements N, P, V, Nb, As, Sb, and Bi of group V of the periodic table are in their compounds with four or five groups of atoms, surrounded by groups arranged in tridimensional space, and can thus act as centres of optical activity.

During the present work we have had occasion to examine the conflicting records concerning isomerism possibly occurring in methyl-diethylsulphonium compounds. Krüger (*J. pr. Chem.*, 1876, [ii], 14, 205) and Nasini and Scala (*Gazzetta*, 1888, 18, 67) obtained two sulphonium iodides according as they treated diethyl sulphide with methyl iodide, or methyl ethyl sulphide with ethyl iodide. Klinger and Maassen (*Annalen*, 1888, 243, 193) consider that trimethyl- and triethyl-sulphonium iodides are produced during the latter reaction, and that the platinichlorides of these form a double salt which is naturally not identical with methyl-diethylsulphonium platinichloride. We hope shortly to publish details confirming Klinger and Maassen's conclusions, having isolated the same platinichloride from the product obtained by heating methyl ethyl sulphide with ethyl iodide and water, as by crystallising together trimethyl- and triethyl-sulphonium platinichlorides. Any objection to the tetrahedral nature of asymmetric sulphur compounds which might be based on the work of Krüger or of Nasini and Scala can therefore be set aside.

The rather large differences between the smoothed and observed volumes of both liquid and of saturated vapour at the highest temperature are due to the alteration of the temperature scale in accordance with Biot's formula for vapour pressures. It is also to be noticed that between 280° and the critical temperature, 296.2° , only one determination of volume was made. The curves above 280° are therefore of little value, especially as the alteration of form is so rapid near the critical point. The vapour pressure curve, however, shows no such change of form near the critical point, and the number of observations in that case is sufficient. Again the critical volume, being calculated from the critical density which is ascertained by the method of Cailletet and Mathias, is not rendered doubtful by the small number of observations near the critical point.

In calculating the critical density the slight curvature of the "diameter" was taken into account. The densities of liquid and of saturated vapour, the mean densities, and those calculated from the formula

$$D_t = 0.3592 - 0.0003986t - 0.000000096t^2,*$$

are given in the table on p. 1150.

The densities of saturated vapour at and below 120° were calculated from the vapour pressures on the assumption that the vapour densities are normal.

The density at the critical point, calculated from the above formula, is 0.2327 ; from the simpler formula

$$D_t = 0.3634 - 0.00044t$$

it would be 0.2331 . The difference, 0.0004 , is small, but at the lowest temperatures it would be considerable, amounting to 0.0042 at 0° .

Critical Constants.

The critical constants are as follows :

Temperature	296.2°
Pressure	18730 mm.
Density	0.2327
Volume of a gram.....	4.297 c.c.
Molecular volume	488.9 c.c.

* These constants differ slightly from those given in a paper on the law of Cailletet and Mathias recently read before the Physical Society. The agreement between the calculated and observed mean densities is somewhat better with the new constants.

Temperature.	Densities.		Mean densities.		$\Delta \times 10^4$
	Liquid.	Saturated vapour.	Observed.	Calculated.	
0°	0·7185	0·0000	0·3592	0·3592	0
10	0·7102	0·0000	0·3551	0·3552	+1
20	0·7022	0·0001	0·3511	0·3512	+1
30	0·6942	0·0001	0·3471	0·3472	+1
40	0·6860	0·0002	0·3431	0·3431	0
50	0·6778	0·0003	0·3391	0·3390	-1
60	0·6694	0·0004	0·3349	0·3349	0
70	0·6611	0·0006	0·3308	0·3308	0
80	0·6525	0·0009	0·3267	0·3267	0
90	0·6438	0·0013	0·3226	0·3225	-1
100	0·6351	0·0017	0·3184	0·3184	0
110	0·6260	0·0023	0·3142	0·3142	0
120	0·6168	0·0033	0·3101	0·3100	-1
130	0·6071	0·0043	0·3057	0·3058	+1
140	0·5973	0·0055	0·3014	0·3015	+1
150	0·5875	0·0069	0·2972	0·2972	0
160	0·5772	0·0086	0·2929	0·2930	+1
170	0·5667	0·0107	0·2887	0·2887	0
180	0·5556	0·0132	0·2844	0·2843	-1
190	0·5441	0·0161	0·2801	0·2800	-1
200	0·5317	0·0196	0·2757	0·2756	-1
210	0·5189	0·0237	0·2713	0·2713	0
220	0·5053	0·0287	0·2670	0·2669	-1
230	0·4901	0·0348	0·2624	0·2624	0
240	0·4732	0·0424	0·2578	0·2580	+2
250	0·4554	0·0512	0·2533	0·2535	+2
260	0·4364	0·0622	0·2493	0·2491	-2
270	0·4123	0·0772	0·2448	0·2448	0
280	0·3818	0·0983	0·2401	0·2401	0
290	0·3365	0·1346	0·2356	0·2355	-1
296·2 (critical)	—	—	—	0·2327	

Theoretical Conclusions.

The absolute temperatures and the molecular volumes of liquid and saturated vapour were read from the curves at the usual series of "reduced pressures"; from these data, the ratios of the temperatures and volumes to the critical constants were calculated, also the ratios of the actual to the theoretical densities of saturated vapour (see table on p. 1151).

A comparison of these ratios with those of normal pentane, hexane, and heptane confirms the conclusions previously reached that, for the members of a homologous series of paraffins, the ratios of the absolute temperatures at any series of corresponding pressures to the absolute critical temperatures, also the ratios of the actual to the theoretical densities at the critical points, increase slightly with rise of molecular

weight, whilst the ratios of the volumes of liquid at corresponding pressures to the critical volumes diminish slightly. The ratios of the volumes of saturated vapour to the critical volume differ very slightly from the corresponding ratios for normal heptane, and are on the whole very slightly lower; they are, however, higher than for normal hexane or pentane. It would appear then that, as a rule, these ratios increase with rise of molecular weight, but that the actual changes are too small, relatively to the experimental errors, to allow of a definite statement being made.

It is hoped that it may be possible to add a fifth member, butane, to the series of normal paraffins.

Reduced Pressure.	Pressure.	Absolute temperature.	Molecular volume.		Abs. Temp.	Vol. Liq. Crit. Vol.	Vol. Sat. Vap. Crit. Vol.	Density Sat. Vap. Theor. Density.
			Liquid.	Saturated vapour.				
0.000590	11.05	294.0°	162.17	—	0.5165	0.3317	—	—
0.001474	27.60	310.9	165.39	—	0.5462	0.3383	—	—
0.002949	55.25	325.25	168.32	—	0.5714	0.3443	—	—
0.005898	110.5	341.25	171.73	—	0.5995	0.3513	—	—
0.011795	220.9	359.30	175.83	—	0.6313	0.3597	—	—
0.022411	419.8	378.5	180.51	—	0.6650	0.3693	—	—
0.044232	828.5	401.85	187.02	27400	0.7060	0.3826	56.1	1.099
0.088465	1657	429.4	195.84	14340	0.7544	0.4006	29.3	1.128
0.14744	2762	452.75	204.62	8730	0.7954	0.4186	17.9	1.167
0.20642	3866	469.85	212.39	6200	0.8255	0.4345	12.7	1.218
0.29488	5523	489.4	222.92	4240	0.8598	0.4560	8.67	1.300
0.44232	8285	513.75	241.11	2660	0.9026	0.4932	5.43	1.452
0.68978	11047	532.3	260.29	1851	0.9352	0.5324	3.79	1.617
0.78721	13810	547.5	284.40	1331	0.9619	0.5818	2.73	1.852
0.82568	15465	555.4	305.22	1089	0.9758	0.6243	2.23	2.049
0.88465	16570	560.35	—	—	0.9845	—	—	—
0.94363	17675	565.0	—	—	0.9926	—	—	—
0.97313	18225	567.2	—	—	0.9965	—	—	—
1.00000	18730	569.2	488.9	488.9	1.0000	1.0000	1.000	3.863

In conclusion, I wish to express my thanks to the Government Grant Committee of the Royal Society for a grant by means of which the cost of the material employed in this research was defrayed.

UNIVERSITY COLLEGE,
BRISTOL.

molecular weight of cane sugar is used. Basic lead acetate is added, the liquid filtered, the lead removed exactly by dilute sulphuric acid, and the glucosazone precipitated by phenylhydrazine at the ordinary temperature. The filtrate on warming to 50° gave a further quantity of glucosazone. The yield is about 30 per cent. of the weight of the cane sugar taken.

The substance after recrystallising twice from absolute alcohol melted at 205° with decomposition and, after drying at 105° , gave on analysis the following numbers :

0.1892 gave 0.417 CO_2 and 0.107 H_2O . $\text{C} = 60.1$; $\text{H} = 6.2$.

0.18 ,, 24 c.c. moist nitrogen at 14.5° and 752 mm. $\text{N} = 15.5$.

$\text{C}_{18}\text{H}_{22}\text{O}_4\text{N}_4$ requires $\text{C} = 60.3$; $\text{H} = 6.1$; $\text{N} = 15.6$ per cent.

Action of Potassium Persulphate on Glucose.

A 10 per cent. aqueous solution of glucose containing 0.8 per cent. of ferrous sulphate is treated with a quantity of solid potassium persulphate sufficient to provide one atom of active oxygen per gram-molecule of sugar. The solution is warmed at 40° until the ferric iron formed begins to be reduced to the ferrous state ; it is then allowed to stand at the ordinary temperature for some hours and afterwards treated with basic lead acetate, filtered, the lead removed from the filtrate by sulphuric acid, and the glucosazone precipitated at the ordinary temperature on addition of phenylhydrazine acetate. The yield of the osazone is 6 grams from 25 grams of glucose.

On recrystallisation from alcohol, the melting point was found to be 205° , and a nitrogen determination in a specimen dried at 100° gave the following numbers :

0.1725 gave 23 c.c. moist nitrogen at 15° and 760 mm. $\text{N} = 15.35$.

$\text{C}_{18}\text{H}_{22}\text{O}_4\text{N}_4$ requires $\text{N} = 15.6$ per cent.

The authors wish to state that this research was carried out with the aid of a grant from the Chemical Society Research Fund and that they are indebted to Mr. F. M. Oldham for assistance in the experimental work.

GONVILLE AND CAIUS COLLEGE LABORATORY,
CAMBRIDGE.

minations of the partial pressure of ammonia over ammoniacal salt solutions.

All the above experiments were carried out at 20°; we have also investigated the influence of temperature on the dissociation equilibrium in ammoniacal salt solutions.

Experiments have been made at 25° and at 30° with *zinc sulphate solutions*, and the results are tabulated below :

At 25°, $k = 24.9$ (see page 1243) :

Total NH ₃ in original solution. Gram-mol. per litre.	Concentration of NH ₃ in CHCl ₃ . Gram per litre.	Concentration of NH ₃ in aqueous part. Grams per litre.	Coefficient. k .
With 0.1 normal :			
0.466	0.1878	7.761	41.2
0.657	0.3090	10.910	35.3
With 0.05 normal :			
0.468	0.2499	7.744	31.0
0.562	0.3061	9.294	29.7
0.655	0.3715	10.800	29.1
With 0.025 normal :			
0.280	0.1518	4.629	30.5
0.375	0.2138	6.181	28.9
0.469	0.2754	7.728	28.0
0.566	0.3450	9.309	26.9
0.652	0.4071	10.723	26.4
0.653	0.4046	10.746	26.6

At 30°, $k = 23.2$ (see page 1243) :

Total NH ₃ in original solution. Gram-mol. per litre.	Concentration of NH ₃ in CHCl ₃ . Gram per litre.	Concentration of NH ₃ in aqueous part. Grams per litre.	Coefficient. k .
With 0.1 normal :			
0.573	0.2738	9.512	34.7
0.669	0.3375	11.088	32.8
0.765	0.4096	12.648	30.9
With 0.05 normal :			
0.384	0.2033	6.342	31.2
0.480	0.2703	7.925	29.3
0.573	0.3366	9.442	28.1
With 0.025 normal :			
0.193	0.1006	3.183	31.6
0.333	0.2339	6.309	27.0
0.575	0.3652	9.445	25.9

A comparison of the numbers obtained at these higher temperatures with those for 20° shows that the nature of the equilibrium in solution has undergone no change. The calculation of the quantity of fixed ammonia from the above experimental data shows that for 1 molecule of salt there are from 3 to 4 molecules of ammonia combined. As at 20° , also, increasing concentration of ammonia tends to make this molecular ratio approximate gradually to the limiting value of 4.

At corresponding concentrations of salt and ammonia, increase of temperature is accompanied by a decrease of the distribution-coefficient, as was also found to be the case for pure water. The variation is, moreover, of the same relative order of magnitude in the two cases, in consequence of which the question as to the influence of temperature on the dissociation of the molecular complexes in solution cannot be deduced with certainty from the experiments. We hope, however, as the result of further investigations, to be able to ascertain this influence of temperature.

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